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FLIGHT

AIRCRAFT, SPACECRAFT, MISSILES

Official Organ of the Royal Aero Club First Aeronautical Weekly in the World Founded 1909

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IN THIS ISSUE

From All Quarters 520
Transport by Hovercraft 522
Missiles and Spaceflight 523
Flight System Survey 525
Down With Mach 3 527
Anything to Africa 529
Training Hunter Pilots 531
Cessna Circus 534
Flying the Scimitar 538
Straight and Level 539
Australia's Airline Policy an Economic Success 540
Sport and Business 542
Air Commerce 543
Service Aviation 548
Correspondence 549
The Industry 550

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Shock-wave Shock-treatment

TO the more ardent followers of what we have called the international supersonic debating society recent contributions by two British spokesmen—Morien Morgan (*Flight*, March 18) and Beverley Shenstone (pages 527-528 of this issue)—will have come as pails of cold water over the fires of dialectics. It was Mr Morgan who first damped things down with some timely shock treatment when he remarked, "For medium ranges (stage lengths of 1,500 nautical miles) it is suggested that current advances in aerodynamic knowledge of sweepback will *allow cruising speeds to rise to M1.2.*" The italics are our own. Now we have Mr Shenstone laying about him with a few more dowsing bucketsful, sample contents being: "Nothing annoys an airline more than to be told by a manufacturer that there is no choice but to buy a certain line of goods. This is what has been going on and it is about time it stopped. Several firms are going around saying that the only thing for airlines to buy is the M3 or 3+ airliner. Why this number? Is it really the best number for the airlines? Was it chosen for, or by, the airlines? It was not. I have not found an airline engineer who wants M3 . . . "

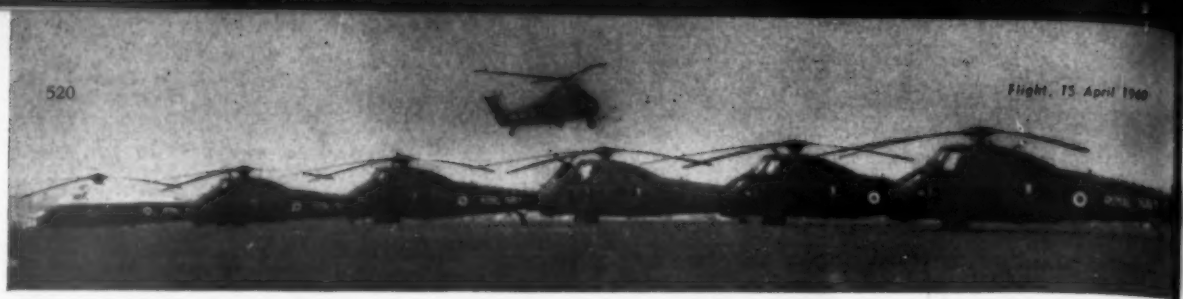
Using an increment of 40 per cent in speed rise Mr Shenstone arrives at a figure of about M1.3, for which speed, he declares, military data and research on economics have shown that good useable aircraft can be built. The fact that this would be a practical technical job, he says, may be one of the reasons it has not loomed large in literature.

Water-cooled Reasoning

But although Mr Shenstone may be given to the dispensing of buckets of water, he is far from being a stick-in-the-mud; and although he considers it may be against some of the airlines' interests he looks ahead to see how far an operator dare go. He summarizes his findings characteristically: "If I were an airline and had chosen to order an M2 transport and my competitor had decided to order M3, I would be the happiest airline in the world because I would know from all the research done to date that I would have years and years of operation without serious competition. I would watch my competitor's development costs climbing. I would watch his rubberized delivery dates stretching and, with some concern, I would see the manufacturer regretting his first assumptions on break-even production numbers."

Now, water-cooled reasoning of this sort is well understood by American engineers—especially when they are not afflicted by the hot breath of the public relations director down their necks. We ourselves have previously drawn attention to the intrusion of "PR" into the technical supersonic scene, and Mr Shenstone voices suspicions of his own. "May not this huge public relations and deceiving-the-enemy battle," he asks, "mean that manufacturers hope to divert the competition into the most impossible Mach numbers, so that they can quietly and quickly produce a satisfactory M2 aircraft in light alloy, with the minimum of extra problems and a life long enough for any airline?"

There is a piquancy in his recent address before the Society of Automotive Engineers that is also worthy of remark. The M1.3 design which he envisages would, he said, be an extrapolation of the classical aircraft, with either a simple swept wing or an M wing. The favourite formula, in fact, seems to be the "big M"—an effective method of achieving sub-critical aerofoil flow at about M1.3 and one which has been the subject of serious study and research in America—more so, perhaps, even than in Britain. The debating society is still in session.



INTENSIVE SERVICE TRIALS of Westland Wessex anti-submarine helicopters are now beginning (see item on page 548). This picture shows a production Wessex hovering over a line-up of some of the pre-production and production machines. All have the Napier Gazelle turbine

FROM ALL QUARTERS

SC.1 Completes Transition

ON Wednesday, April 6, Tom Brooke-Smith, chief test pilot of Short Bros & Harland Ltd, took the SC.1 over its greatest hurdle of all, with a flight which included a full transition to hover and, after some seconds, a transition back into level flight. Initial take-off and final landing from the RAE, Bedford, were made in winged flight. This completes the full flight envelope of the SC.1, leaving the way clear for adoption of the system for other types, notably VTOL strike aircraft projects and supersonic airliners of Griffith concept.

The SC.1 is unique in having separate lifting and propulsion engines, and the full safety of triplicated stabilization controls. It first flew, as a conventional aeroplane, on April 2, 1957, and hovered in a gantry at Belfast on October 25, 1958.

Its recent test programme involved closing the gap between slow translation and the 1g stall in winged flight which occurs at 134kt. First, translational speed was increased by 10kt increments to 80kt, checking at each stage that compressor pressure in the lift engines was outside the surge boundary. The Rolls-Royce RB.108 engines have, in fact, behaved extremely well, and respond immediately to pilot demand. Then, at a height giving adequate safety but sufficient lifting thrust, speed was progressively reduced from 140 to 75kt in a large number of steps. The final flight bridged the gap.

Lift-engine thrust is controlled by a lever like the collective-pitch control of a helicopter, and propulsion-engine thrust from a twist-grip on the end of the same lever. Lift-engine tilt is controlled by an electric trimming switch. Attitude change in forward and hovering flight is regulated by the normal control column and autostabilization, the latter being triplicated in roll and pitch. In winged flight the SC.1 is a vehicle rather than a true aircraft, but in transition and hover, according to Brooke-Smith, it is "the sort of aircraft to play with on a Sunday afternoon." Vertical take-off, he said, was straightforward, using the lever. Twist-grip was then operated to apply full forward thrust and the lift engines were also tilted. Smooth acceleration for about 25sec with the nose slightly down produced winged flight speed, after which the lift engines could be throttled back or switched off. Air starting was quick and simple. For transition to hover at about 50ft, speed was reduced at around 1,500ft and lift power applied as sink developed. Speed fell off to zero in about 30sec. Nose-up pitch at below 130kt in earlier tests had been overcome by increasing pitch control.

Ingestion of foreign matter over loose surfaces during hovering was a problem, but only at heights below 30ft. The take-off platform now had perforations beneath the lift engines only, so that hot gases were led away from the wing and ground suction alleviated. One of the two SC.1s (XG 900 and 905) is now to be handed over to the RAE; the other will be used for further trials by Short & Harland.

CONVERT: As noted above, the Short SC.1 has now accomplished full transition from wing-supported flight to hovering and back to forward flight. No other pure-jet machine in the world has done as much. The powerplants are five Rolls-Royce RB.108 turbojets, one of which is fixed horizontally for propulsion. The pilot is Tom Brooke-Smith

DMET Confirmed as ICAO Standard

IN the ICAO Council last Friday, the USA marshalled the bare two-thirds majority needed to confirm DMET as an international standard navaid to supplement VOR. Those voting with the USA were Venezuela, Spain, Philippines, Japan, Brazil, Argentina, West Germany, Guatemala, Italy, Lebanon, Holland, Portugal, and the UAR. Britain, France, Denmark, India, Australia, Canada and South Africa voted against. France has thus ceased to support DMET. The UK representative to ICAO has called VOR/DMET "inflexible, semi-obsolete, basically inaccurate and not efficient." Britain will undoubtedly react strongly, having already refused to implement DMET, and a major split in ICAO might result.

Mr Sandys on the Continent

ON visits to France and Germany this month the Minister of Aviation, Duncan Sandys, is renewing discussions with the French Government about possible collaboration in aviation and guided weapons and electronics. After his French visit (April 11-14) Mr Sandys is going to Germany from April 21 to 25. While there he will visit the Hanover Trade Fair, concurrently with which the Hanover Air Show is being held, with about a score of British aircraft, engine and equipment firms exhibiting.

SBAC's 21st Show

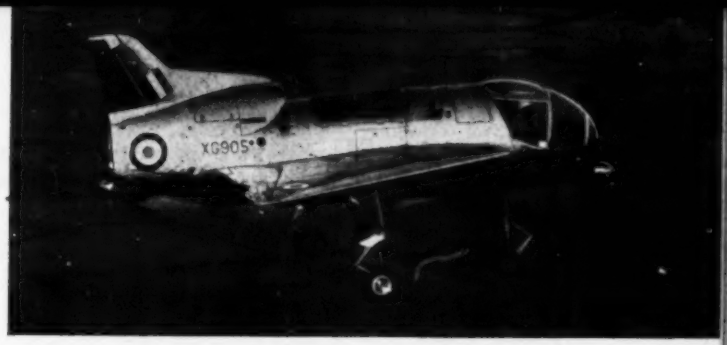
THIS year's SBAC Show at Farnborough, from September 5 to 11 (with public admission on the 9th, 10th and 11th), will be the 21st to be staged since the first was held in 1932. In spite of a considerable increase in the available area, applications for stand space in the exhibition building and for enclosures have for the first time had to be turned down. Though the floor space at the exhibition building will be the same as last year the actual stand space will be greater, and the missile park may be enlarged.

Westland Aircraft Changes

ORGANIZATION changes have been announced by Westland Aircraft Ltd following their acquisition of other companies and integration into a single specialist helicopter group.

Sir Reginald Verdon Smith and C. N. Chichester Smith have been elected to the board; E. C. Wheeldon, managing director, has also been appointed a joint deputy chairman; D. L. Hollis Williams and W. Oppenheimer have been made assistant managing directors; and A. R. B. Hobbs has been appointed secretary.

The following special directors have been appointed. In the Yeovil division, E. J. Boulger (group contracts manager), O. L. L. Fitzwilliams (chief engineer), E. J. Frost (works manager), C. T. Jones (group insurance manager) and H. J. Penrose (group sales manager); in the Saunders-Roe division, M. W. C. Gordon



***WING-SUPPORTED:** This first air-to-air view of the second SC.1 shows the machine cruising at some 160kt near Bedford. As noted on the opposite page, this aircraft has now accomplished complete transition*

(general manager); in the Bristol division, R. Hafner (chief engineer); and in the Fairey division, H. W. D. Winkworth (general manager) and Dr G. S. Hislop (chief engineer).

Four appointments have also been announced by Normalair Ltd, a wholly owned subsidiary of Westland Aircraft. They are of E. C. Wheeldon as chairman, D. C. Collins as managing director, Dr E. W. Still as assistant managing director and T. Bretherton as secretary.

Dowty Rotol Directors

MEMBERS of the board of Dowty Rotol Ltd, from April 1, have been named as follows: Sir George Dowty, FRAES, MIMechE (chairman), C. J. Luby, AFRAES, MIPE, and E. J. Nicholl, BSc(Eng), FRAES (joint managing directors); A. E. Atkins (works director); L. T. P. Banbury, JP, FACCA; H. S. Butt, OBE (experimental works director); L. G. Fairhurst, FRAES, MIMechE (technical director); R. F. Hunt, AFRAES; F. J. A. Mangeot, FCA (commercial director); and G. F. M. Rufford, FCA, ACWA (financial director).

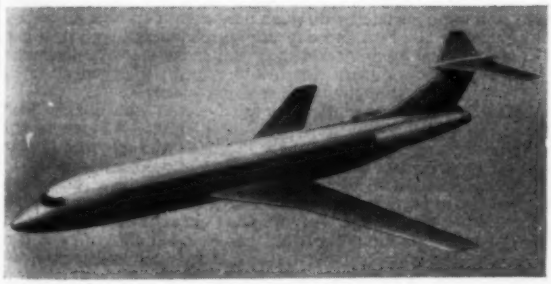
Ian C. Reid

WE record with regret that Ian C. Reid, sales manager of Scottish Aviation Ltd, died in hospital at New Delhi on April 5 after a short illness. He had been on a sales promotion tour in the Far East for the past two months, and was taken to hospital on March 28.

Mr Reid, who was 47, joined the Scottish Aviation staff in 1945; before that he was with the AID at Blackburn and General Aircraft at Dumbarton and Scottish Aviation at Prestwick. He had been sales manager for Scottish Aviation for the past six years, having previously been their technical sales manager.

West Germany's "Caravelle"

MORE details are now available of the Hamburger Flugzeugbau HFB314 short-range jet transport project (*Flight*, November 20, 1959, page 608). Though the West German government is reported to have decided not to subsidize the project, the manufacturers have outlined its likely development.



Artist's impression of the HFB314 project

Powerplant would be two Rolls-Royce RB.141/3, as proposed for the 1963 Caravelle 7, each rated at 14,340lb guaranteed minimum. Gross weight of the HFB314 is given as 88,700lb; maximum landing weight, 83,800lb; length, 119ft; span, 93ft.

Intended for European short- and medium-range routes, the HFB314 will carry up to 78 passengers on sectors of between 310 and 1,250 miles. Break-even capacity load factor for a 1,250-mile sector is given as 38 per cent, or 20 per cent with 2,250lb of freight. Price, based on 100 aircraft, would be about £700,000, or £600,000 based on a production run of 200 aircraft.

The manufacturers estimate that the prototype could fly 30 months after the award of a development contract, and the flight-test programme would, they reckon, take one year.

Assuming that the HFB314 will not be built as a private venture, it seems that the West German rival for the Caravelle (a curious duplication in the common market) has yet to get a go-ahead. Meanwhile the French and German industries have agreed upon a joint effort in the Nord Transall (R-R. Tynes).

Conformity Criticized

SPEAKING at the twelfth annual dinner of the College of Aeronautics Senior Common Room at Cranfield on April 1, Sir Alfred Pugsley, professor of civil engineering at Bristol University, called attention to the bad effects of conformity in education and research at the present time. He hoped that there would always be many aeronautical nonconformists and heretics at Cranfield.

Prof J. Loxham of the Department of Aircraft Economics and Production described as a significant development the advent of the Advanced School of Automobile Engineering, which was to be set up at Cranfield later this year. Within the next decade, he suggested, machines would have been perfected to provide a high general standard of living, but this should be accompanied by parallel research and study into the important subject of human relations.

The two final speakers at the dinner, C. K. Trotman of the Department of Aircraft Design and Prof E. J. Richards of Southampton University, treated those present to a rare but unreportable miscellany of Welsh humour.

IN BRIEF

The Fairey Company announced that R. L. Lickley has resigned from their board as from March 31 and has relinquished his appointments with the subsidiary companies of the Group.

There is to be no public inquiry on the sale of Chalgrove Airfield to the Martin-Baker Aircraft Co Ltd. This was stated by the Under-Secretary of State for Air, W. J. Taylor, on March 31.

A successful landing at a height of 16,000ft in the Himalayas was made on March 28 by Ernst Saxer in *Yeti*, the Pilatus Porter which is accompanying the the Swiss expedition attempting to climb Mount Dhualagiri.

On April 4 the French Government announced that, following the successful test of a transportable nuclear device in the Sahara on April 1, a first batch of 50 Dassault Mirage IV bombers is to be bought. First delivery will be made in 1963.

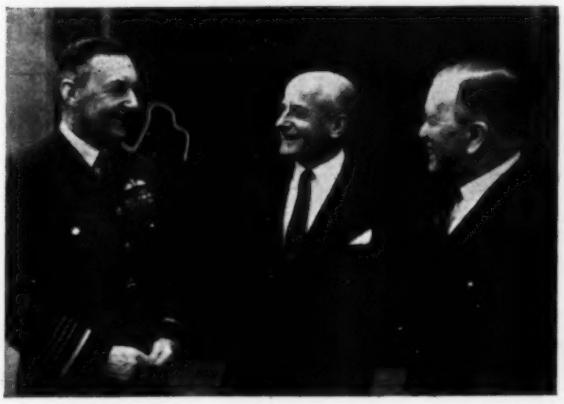
The main event in the Aircraft Recognition Society's calendar, the president's address, takes place next Wednesday, April 20. Mr Masefield has chosen as his subject *Survey of Civil Aviation, 1960*. The venue is the RAeS library, 2 Hamilton Place, London W1, and the time 7 p.m.

A Turboméca Marboré turbojet (loaned by Blackburn Engines Ltd) is being mounted on the SRN-1 Hovercraft to provide about 880lb additional forward thrust, thus giving information about the behaviour of the Hovercraft at considerably increased speeds. These trials are expected to start next month.

Lockheed Aircraft had a record year in 1959. Their annual report shows total sales of $1,301,565,000; of this total 23 per cent were airliners and exports, 35 per cent were aircraft, ships and services for the US Government, and no less than 42 per cent was accounted for by missiles, space vehicles and electronics. For comparison the proportions in 1953 were 9, 91 and 1.

Jose Ansaldo's attempt to cross the South Atlantic in a 35,300 cu ft balloon was postponed shortly before take-off from the Canary Islands on April 4, when (it is reported), a helicopter carrying photographers flew low overhead, its rotor downwash tearing the balloon's plastic envelope. Sr Ansaldo, a 61-year-old aeroplane pilot with over a million air miles to his credit, is operations manager of Iberia, the Spanish airline.

***CAS AT DERBY:** Air Chief Marshal Sir Thomas Pike, Chief of the Air Staff, recently visited Rolls-Royce to see their research and development work. He was accompanied by Sir Maurice Dean (right), Permanent Under-Secretary of State for Air, and here both visitors are chatting with J. D. Pearson, chief executive and deputy chairman*



Transport by Hovercraft

THE VIEWS OF THE INVENTOR

BEFORE the Royal Society of Arts in London on April 6, Christopher Cockerell, MA, inventor of the Hovercraft, delivered a paper entitled *The Hovercraft and its Place in the Transport System*. R. A. Shaw, OBE, MA, FRAeS, Assistant Director, Aircraft Research, MoA, was in the chair.

Mr Cockerell opened his paper by giving a review of existing forms of land, air and water transport. The following is an abstract of the section devoted to the Hovercraft itself.*

"Hovercraft" [said the lecturer] is the British name for the class of surface craft which rides on a layer of pressurized air. This air-layer is required not only to reduce the drag, but must also be thick enough to act as an almost inertia-less suspension system. The craft must be of a sufficient size to contend with the roughness it will meet at the speed for which it is designed. Waves of the order of twice craft-length or less must be cleared, necessitating a calm-water clearance of about half the height of such waves. For longer waves the craft will tend to heave, and the really long waves can be followed, much as a car travels over rolling Downs.

[*The lecturer here illustrated weight/speed envelopes of various types of air and water craft—his diagram is reproduced below—and went on to discuss the varieties of hovercraft envisaged.*]

In the 10-30kt speed and 1,000-10,000-ton weight range [he said] is shown a side-wall hovercraft with water jets, but little work has been done with such craft. In the 20-60kt and 10-1,000-ton envelope is the side-wall river hovercraft, which would appear both practical and promising. It would not generally be safe to operate large hovercraft at speeds in excess of 40kt because of the presence of smaller craft.

The best speed for sheltered-water and Channel ferries would seem to be in the range 70 to 120kt and this range is covered by the Hovercraft envelope. Here air propulsion and air jets come into their own. After many years, there may also be open-water, ocean-going craft in this category.

At speeds above about 130kt aerodynamic lift begins to be an important factor, so there may be another category of high-speed hovercraft which travel higher-up to, perhaps, 40ft calm-water clearance—but which are at all times partially "cushion-borne." Such craft, due to their speed, would be unable to follow even comparatively long waves, would have to travel higher, and would also have to be large.

The last envelope is labelled "air-bearing railcars," as proposed by Ford, and they represent the other extreme—a cushion-supported craft with a very thin layer of air operating on a smooth steel rail. Such craft would probably yield the best propulsive efficiency of any vehicle known.

The survey [added Mr Cockerell] would be incomplete without mention of the cushion-cum-aircraft combination which Mr Frost of Avro Canada has been working on for some years.

At present aircraft use wheels for landing and for take-off. It is interesting to speculate what the effect would be on the performance, and more particularly on the maximum practicable size, if a cushion landing-system were substituted, the aircraft remaining partially cushion-borne up to speeds of perhaps 200kt. Will a cushion landing-system and an atomic power-unit eventually make practicable a really heavy inter-continental air-freighter?

Before attempting to give some indication of possible operating costs, it is of interest to investigate the density of the loads which best suit the various forms of transport. The range is quite enormous, from 15 cu ft/ton for a load of iron ore to 20,000 cu ft/ton of passengers and their baggage. The range of space allocated to one passenger in existing transport is also very great, from about 12 cu ft for an uncomfortable crowded tube train to some 2,000 cu ft for an Atlantic liner.

Ships and atomic submarines are at their best when carrying dense loads, such as oil or wheat, which require about 40 cu ft/ton, the payload then being a large proportion of the displacement. As a passenger carrier, a liner only carries one passenger for every 20 to 40 tons of displacement, and the figure for a Channel ferry is about two tons per passenger, so that even here the payload is only about 5 per cent of the displacement. A load of motor cars is about one-tenth of the density of oil or wheat, and so cars are not a suitable load for a ship.

The figures for aircraft vary from about one-third to two-thirds of a ton of all-up weight per passenger, depending upon stage-lengths, so that the passenger payload is in the range 10 per cent to 20 per cent of the all-up weight; hence aircraft are better suited to passenger-carrying than are ships.

Basic Hovercraft of 100 tons or more will have cushion loadings of 50 to perhaps 150lb/sq ft of plan area, and about two-thirds of the plan area will be available for accommodation. The average car of about 1½ tons requires about 100 sq ft of plan area, giving a loading of 22lb/sq ft based on craft plan/area. About eight passengers and their luggage can be accommodated for short durations in 100 sq ft giving a loading of about 11lb/sq ft of craft plan area. Such loadings are very suitable for Hovercraft.

The total power required for a hovercraft is made up of that required for lift and that required for propulsion. The specific lift power decreases with increases in craft size, but increases with clearance height, and therefore with the range of wave conditions with which any given craft is designed to contend. However, very considerable improvements in lifting efficiency may be expected, not of the order of 5 per cent or 10 per cent, but of the order of two or three times for large craft during the course of development. Such improvements are already a reality in the laboratory.

The power required for propulsion is largely used to overcome the air drag associated with pushing the craft and the air cushion through the air; but, and depending upon the design, there may be some water-skin-friction drag under adverse sea conditions. These are the dominant drag components, for in general hovercraft wave drag is negligible at cruising speed.

As to costs, consider first the capital cost of a hovercraft. Small craft of two to 100 tons will have refined structures, and their costs are likely to be high; but craft of 1,000 tons or more will have structures with ¼in or ⅜in light-alloy plating, and will be much more akin to a ship than an aircraft. The shipbuilding industry can fabricate and finish a light alloy ship's superstructure for about £500 per ton. An equipped airframe costs of the order of £20,000 per ton. There is therefore a different of at least 40 to 1 based on weight, between the cost of a one-off ship's superstructure and a batch of equipped airframes. This difference is so great that any estimate of a hovercraft first cost can only be approximate. If the cost of the structure of a 1,000-ton hovercraft is based on £4,000 per ton—that is eight times more than that of a light alloy ship's superstructure, and five times less than that of an airframe—then the cost of the complete 1,000-ton ferry is estimated to be £4m. Such a craft would do the work of five or more 3,500 gross ton Channel ship ferries costing £1m each.

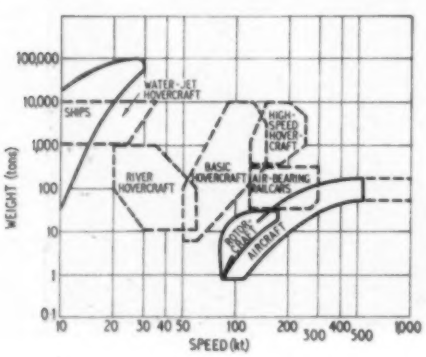
The estimated direct operating costs per passenger-mile at 60 per cent load factor of such a hovercraft ferry may be compared with the direct operating costs of ship ferries, aircraft and helicopters. It will be seen that its only competitor over short stage-lengths is the much slower ship ferry.

Aircraft costs rise quite steeply for short stage-lengths, and it is in this area that the as yet only partially developed hovercraft shows to best advantage. Fares on shorter routes—for example, Dover to Calais—appear very high on a mileage basis and, in fact, so high in this case as to enable aircraft to compete for the traffic.

All these routes suffer from the seasonal nature of the traffic, a situation which would be greatly helped if road-transport were attracted to make more use of the service. However, certain fairly firm conclusions can be drawn:—

- The capital cost of the 1,000-ton hovercraft ferry is about the same as the capital cost of the equivalent five ship ferries.
- The operating costs of the undeveloped hovercraft at 70 to 100kt are very similar to those of a ship ferry at 16 to 20kt.
- Neither aircraft helicopters can compete on short routes.
- The capital outlay for a fleet of aircraft to do the work of one 1,000-ton hovercraft for short routes would be three or four times greater than for the equivalent hovercraft or ship ferries.

Throughout the paper, as printed, Mr Cockerell used the terms "Basic Hovercraft" and "hovercraft" (with a small h) to distinguish between his own invention and cushion-craft generically. In conformity with our practice of recent months, we too have used the capital or small h as appropriate, though usually omitting the word "Basic."



Weight - and - speed envelopes for various types of craft. The side-wall river hovercraft, said the lecturer, appeared to be promising

Missiles and Spaceflight

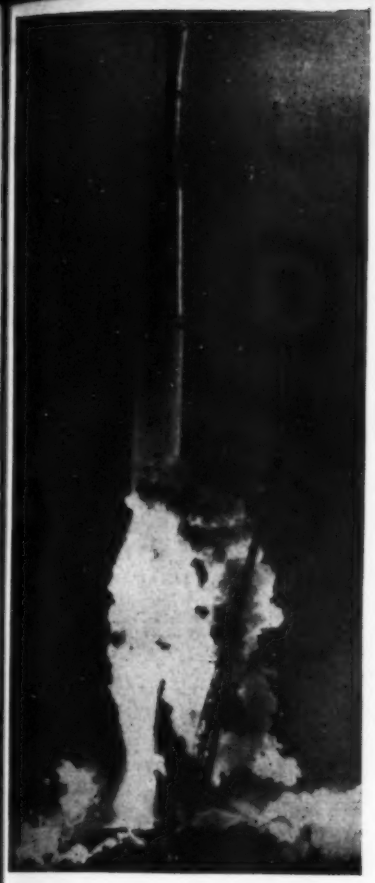
TIROS MAKES GOOD

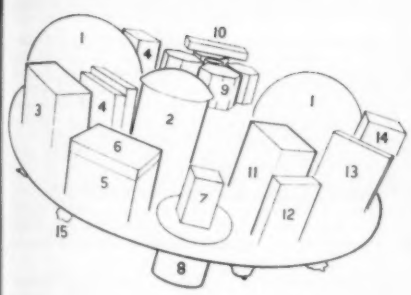
PHOTOGRAPHS of unexpected clarity began to be received from the US satellite Tiros 1 soon after its injection into orbit on April 1. Launched by a three-stage Thor-Able from Cape Canaveral (left), the satellite achieved a 435-468 mile initial orbit at an inclination of 48.3° and with an orbital period of 99min 15sec.

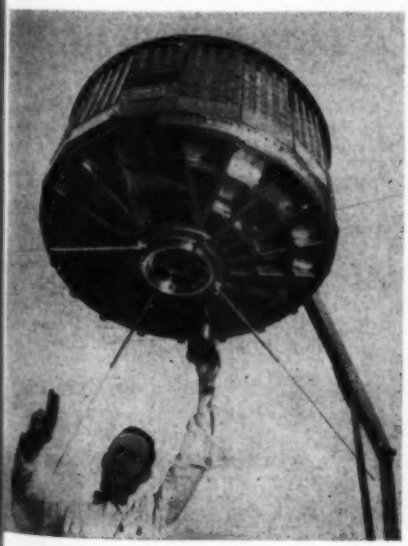
Sponsored by the National Aeronautics and Space Administration, the satellite (below and bottom left) was designed and constructed by the Astro-Electronic Products Division of RCA at Princeton, New Jersey, under the technical supervision of the US Army Signal Research and Development Laboratory, Fort Monmouth, New Jersey. In the photograph below the following equipment can be identified from the numbered outline diagram: 1, tape recorders; 2, electronic timer for operational sequencing; 3, camera electronics; 4, control circuits; 5, television transmitter; 6, auxiliary synchronizing generator for television; 7, one of the two half-inch vidicon television cameras; 8, wide-angle camera lens; 9, chemical batteries; 10, battery charging regulator; 11, auxiliary controls; 12, voltage regulator; 13, power convertor for tape motor; 14, tape recorder electronics; 15, spin-up rockets. Visible in the bottom left picture are the solar cells (9,000 of which form part of the satellite skin), the transmitting aerials extending from the hub of the base, and the lens of the wide-angle television camera (being held by assistant project manager Abraham Schrapf).

At the foot of the page are two of the earliest pictures received from Tiros 1, both taken from a height of approximately 450 miles on April 1. The photograph on the right was taken with the wide-angle lens and shows cloud masses (white) over the north-eastern part of the USA and Canada. The dark area at bottom right is the Gulf of St Lawrence. The other photograph was taken by the second camera carried, a narrow-angle, high resolution type, and shows a smaller cloud area in greater detail. The pictures were received by the Army Signal Corps at Fort Monmouth.

A plan to launch six further Tiros satellites was described on April 2 by Dr Harry Wexler, chief scientist of the US Weather Bureau. One of these would have an equatorial orbit and would be used to photograph cloud masses associated with tropical storms.







The first of 20 Project Mercury capsules was delivered by McDonnell Aircraft Corp to NASA at Wallops Island on April 2. This capsule has been specially instrumented for design tests of the vehicle's escape system

Missiles and Spaceflight . . .

END OF A SPUTNIK

Launched on May 15, 1958, the 2,925lb Soviet satellite Sputnik 3 was believed to have re-entered the dense lower layers of the Earth's atmosphere during the morning of April 6, 1960, after completing approximately 10,040 revolutions. The last observation of the sputnik to be made by the Radio Research Station, Slough, was at 7.43 a.m. on April 6, when the satellite was on its 10,037th circuit at a height of 75-80 miles.

NUCLEAR POWER IN SPACE

Speaking before the Dayton-Cincinnati Section of the Institute of the Aeronautical Sciences last month, Richard E. Horner, associate administrator of the National Aeronautics and Space Administration, said that NASA was spending about $6 million per year on the development of a fluid heat delivery system to be used in a nuclear booster. He referred specifically to the Kiwi project in this connection, and declared that the schedule indicated that the USA was from three to six years away from a flight-weight reactor to be used as a booster.

Nuclear reactors would be used as auxiliary power sources for space vehicles, however, within two to three years. Mr Horner went on to indicate that nuclear auxiliary power sources were coming along nicely, and the real problem in using them had more to do with obtaining sufficiently large boosters to put them into orbit, than with the auxiliary power units themselves.

NASA was not working on air-breathing boost systems to carry out the first-stage launching of space vehicles and missiles, the speaker said. (Such units, using turbojet engines, would carry the missile or space vehicle up through the denser layers of atmosphere, whereupon a rocket engine would take over to power the vehicle for the rest of its flight, while the first-stage air-breathing booster would return safely to the ground to be used over and over again.) Air-breathing boost was a project in which the Department of Defense had an interest and so, if any work was to be done on it, it must be done in that Department. The recovery of Saturn first-stage components by parachute was under consideration by the Administration.

SHIPS FOR POLARIS

A contract from the US Navy's Bureau of Ships has been received by the Electric Boat Division of General Dynamics for plans and design services for a third generation of Polaris submarines. Numbered from SFB(N)616 onwards, the new series will incorporate many components evolved from those of the second-generation 608 class. The first Polaris ship, *George Washington*, is number 598.

In addition, a total of $52m has now been made available for the acceleration of the current Polaris fleet ballistic-missile programme. This step is considered justified owing to the fact that all test objectives were achieved in nine out of the last ten firings. How the money will be spent has not been divulged, but a proportion of it will permit extra shifts to be worked on the seven submarines (598-604) currently under construction.

MINUTEMAN BASE

Now that the configuration and basic design parameters of the Minuteman silo have been determined, design work is progressing rapidly on the first fixed-site base for this new missile. Located at Malmstrom AFB, Great Falls, Montana, the complex will house three squadrons of SM-80 Minutemen, all in fully hardened underground bases. Each emplacement will require some two acres of ground, not counting the easements for communications. Each squadron is likely to have more than the six or nine missiles which equip Atlas or Titan squadrons, and its Strategic Air Command personnel will total some 500. Construction contracts for some $20m per squadron will be signed next January, and Malmstrom will be completed between April and July 1962, in time for delivery of the first operational SM-80 missiles.

Studies of the final design of solid-propellant loading and supporting system are nearing completion and it has not previously been revealed that the four nozzles of the first stage of the missile will be arranged to swivel, dispensing with the necessity of drag-inducing jetevators. Further Minuteman news includes repetition of the story that there are to be smaller and larger versions (for ranges of 1,000 and 12,000 n.m. respectively) named Midgetman and Mightyman, and that owing to the sandy terrain at Cape Canaveral the Minuteman complex there has a silo in which the concrete wall is being fabricated above ground and allowed to sink beneath the surface while the interior is scooped out.

According to *Aviation Daily* "Convair and de Havilland Aircraft Co are conducting negotiations on a top-secret missile project."

In a written reply in the House of Commons, the Minister of Aviation has given the cost of building the Rocket Test Establishment at Spadeadam as £19.4m. Running costs have so far been £1.2m.

Martin have used war-surplus rocket motors to reduce the cost of the Bullpup Trainer. This device, currently being test-fired from a B-57, has aerodynamic characteristics similar to those of the operational Bullpup, but is simpler, cheaper and one-fifth as heavy.

Some 3,000 members of the National Brotherhood of Electrical Workers have ceased work at Vandenberg AFB, objecting to cheap-rate non-union labour. Construction is held up on soft and hard installations for Atlas and Titan.

Rocketdyne's solid-propellant division at McGregor, Texas, is in production with a gas-generator to provide accessory power for the Tartar and Advanced Terrier. The fuel is a clean-burning ammonium nitrate, and cemented to the starting end is a boost disc of fast-burning material to provide full hydraulic and electric power almost instantly.

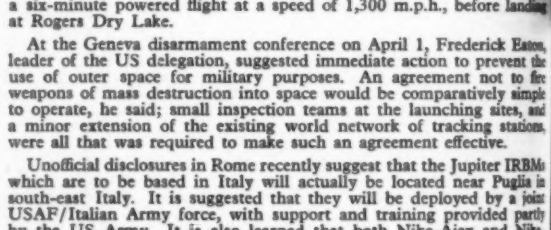
The ninth powered flight by an X-15 research aircraft was made on March 29, with North American Aviation test pilot Scott Crossfield at the controls. The flight was made in the second machine of this type, and began at 45,000ft after release from a B-52. The X-15 climbed a further 5,000ft and was subjected to rolls, turns and a brief dive during a six-minute powered flight at a speed of 1,300 m.p.h., before landing at Rogers Dry Lake.

At the Geneva disarmament conference on April 1, Frederick Eaton, leader of the US delegation, suggested immediate action to prevent the use of outer space for military purposes. An agreement not to fire weapons of mass destruction into space would be comparatively simple to operate, he said; small inspection teams at the launching sites, and a minor extension of the existing world network of tracking stations, were all that was required to make such an agreement effective.

Unofficial disclosures in Rome recently suggest that the Jupiter IRBMs which are to be based in Italy will actually be located near Puglia in south-east Italy. It is suggested that they will be deployed by a joint USAF/Italian Army force, with support and training provided partly by the US Army. It is also learned that both Nike-Ajax and Nike-Hercules are located at some twelve emplacements in the area behind Venice.

Marquardt announce that recent static firings at Edwards AFB have "demonstrated the highest performance ever achieved with storable liquids on a large scale." The original USAF-sponsored programme was aimed at the achievement of a rocket-ramjet unit, the ramjet portion of which has already flown three times on Lockheed X-7s at over M4 above 90,000ft. Static firings of the rocket portion have involved high-energy boron fuel and an unspecified oxidant, operating at some 100,000lb thrust.

As noted in a news-item on this page, the SM-80 Minuteman is designed for silo launching. This one-third-scale "boilerplate" model was used during the evolution of the silo configuration



Latest picture of Ferranti Airpass, ready for test installation in a Canberra. Left to right, the black boxes are the hand controller, attack sight, radar display, fire-control computer and radar. Airpass is shortly to enter service with the Lightning and is fitted to export Saab Drakens. Ferranti have also developed the attack radar for the NA.39

FLIGHT SYSTEM SURVEY

Decca Developments

THE ICAO Council was due to decide for or against the adoption of DMET as an international short-range aid in Montreal last Friday, and news may reach us in time for inclusion in a late-news page of this issue.

Meanwhile Decca have announced a "major breakthrough" with the Omnitrac computer, which is to be capable of converting the normal Decometer readings for pictorial presentation on an undistorted xy grid. The device is claimed to be small, simple and reliable. Decca Group has been working towards this solution for some years and Omnitrac is indeed a major breakthrough, not only for the conversion of Decca outputs to orthomorphic grid but for similar processes in numerous other applications. Additionally, rectilinear Decca presentation can now be combined with those from other position-fixing systems and auto-steering devices in a wide variety of vehicles. Correlation of marine radar with shore-based navaids, for example, and position-fixing for survey work, would be greatly simplified.

Announcing Omnitrac, Decca stated that "we have recently found a manipulation of the mathematics of this conversion which we believe has remained undiscovered for the twenty years or so during which hyperbolic systems have been developing and we are in the process of producing the first model of the computer in airborne form. Knowing the digital and analogue solutions to this problem that have so far been put forward, we are confident our techniques will prove to be so advanced that our digital computer will have a fraction of the complexity of its forebears, a bulk and weight that will compare favourably even with analogue devices of much lower accuracy, and a price which will make it available to a very large number of users in all fields."

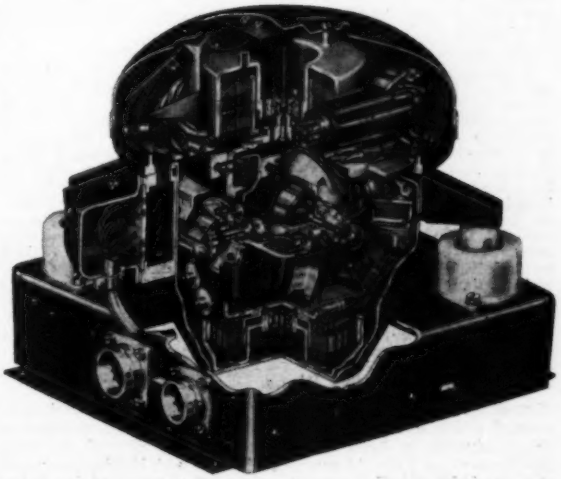
In the House of Commons on April 4, Mr Sandys, Minister of Aviation, replied to two written questions by quoting an official letter sent to the Secretary General of ICAO by the UK representative in Montreal, commenting on the recent Federal Aviation Agency report on helicopter operations with Decca and the trial of a Mk 10 receiver in a Convair C-131. (Comments on these reports appeared in *Flight* for March 4.)

While expressing some satisfaction with the helicopter operations report, the UK representative to ICAO regretted that the UK felt "bound to observe that the supplementary report on Decca Mk 10 suffers by comparison with the principal document and cannot be accepted in the same category of objective reporting." The trial had been "hasty and ill-conceived" and the UK was "unwilling to allow the issue of the supplementary report at the present time and in the present circumstances to pass without comment." The letter drew attention to certain features of the report [which have already been commented on in *Flight*] and concludes that there are "serious doubts on the value of the report from any aspect." The UK representative asked that his comments should be brought to the notice of those ICAO member-States who had received copies of the original FAA report.

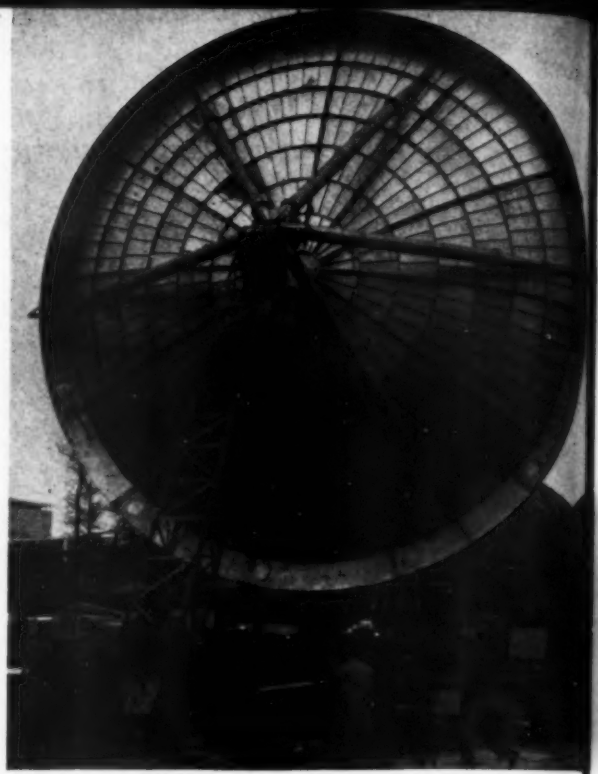
Although the Federal Aviation Agency is firmly opposed to the adoption of Decca as an international short-range aid and is indeed committed to Vortac as the "common system" in the US, its attitude to the use of Decca for helicopter navigation is very different. The Phase I trials which were recently reported on have now been succeeded by Phase II: these trials will involve several thousand hours of IFR helicopter route-flying with multi-engined helicopters controlled from a special traffic centre in the New York area and operating in close proximity to the existing fixed-wing airways.

A review of the Phase II programme remarks that "the jet age is here—the helicopter age is almost upon us." Wider use of helicopters has been retarded for several years, the statement continues, by lack of suitable powerplants, but these are now becoming available and, together with other technological improvements, "will result in an explosive expansion in the use of helicopters." It is noted that scheduled helicopter carriers flew 628,000 revenue passenger-miles in 1955 and 4,885,000 in 1958. The number of passengers carried is increasing 80 times faster than that in fixed-wing transports. Helicopters account for no less than 16 per cent of all operations at La Guardia Airport.

The Phase II schedule called for trials to begin last November with the installation of special equipment in IFR helicopters. In December, initial familiarization flying was to begin and scheduled operation in VFR weather was to start on January 11. On April 1, two weeks ago, scheduled services in actual IFR conditions or with one of the pilots "under the hood" were to start. The aircraft were a twin-engined Sikorsky H-37 of the US Army and a US Marine HR2S. Vertol are scheduled to phase-in twin-turbine helicopters in the future and one Omega BF-12 twin-piston-engined light helicopter was to join the trials if its FAA certification programme proved satisfactory. Sikorsky,



The CL.11 Rotoroce gyro now being produced by Sperry in Britain



A 50ft parabolic forward-scatter communications aerial made by Krupps of Essen for the NATO project "Ace High" communications network is here seen being erected at the site of the forthcoming Hanover Industrial Fair. Some of this equipment was recently landed at Grimsby and taken for testing to RAF Stenigot

SYSTEM SURVEY...

Pratt & Whitney, Vertol, New York Airways and Omega Helicopter Corp were to provide free support for the machines and the Army and Marines respectively provide crews.

Navigational equipment was to consist of Decca Mk 8 receivers duplicated for reliability and supplemented by VOR and ADF. Additional aids such as mapping radar, other hyperbolic systems and Doppler are to be added as the programme proceeds. High-precision altimeters and new instrumentation could also be included. FAA were providing fixed communications and radio as well as direct land-lines between Atlantic City and every heliport on the selected route. The special ATC centre is the first of its kind in the world and one of its major tasks will be to establish whether helicopter operations can be controlled independently of fixed-wing flying. Unless this can be done, say FAA, ATC for fixed-wing aircraft will be considerably affected.

FAA Tests Five AAIs

CURRENTLY under test at the FAA's Experimental Centre at Atlantic City are five angle-of-approach indicator lighting systems, one Australian, one British and three American. The US Navy has submitted a land-based version of the mirror sight and the USAF the "meat ball" system. The latter operates in the same way as the Australian Cumming-Lane arrangement of bars of lights at different heights which are lined up by the pilot much in the same way as the fixed aircraft silhouette is aligned with the horizon bar in an artificial horizon. The "meat ball" system uses a close group of lights as the reference to be aligned with bars of lights—something of a cross between the mirror and Cumming-Lane layout. The British system is the RAE/Thorne two-colour VGPI, which is being widely introduced in Britain; and the third American system is called the Westinghouse "Tri-Color" using a single three-colour light projector on either side of the runway defining high, on or below glide-slope respectively with yellow, green and red beams.

The Cumming-Lane and similar systems provide their indication by the positional relationship of groups of lights whereas the Thorne VGPI indicates by colours. Although MoA chose the colour system following an extensive evaluation of the two principles, there is still much to be said for a geometrical indication which is unaffected by colour changes that could be introduced by atmospheric attentuation in mist and smoke. Adoption of the geometrical system by America might well establish something of an international conflict between supporters of the two basic approaches.

IEE Air Traffic Control Symposium

IN London last Friday the electronics and communications section of the Institution of Electrical Engineers held a symposium on data handling and display systems for air traffic control. The first session, in the afternoon, dealt with flight information processing and its chairman was M. J. L. Pulling. The second session was on radar data handling and was under the chairmanship of C. Williams.

The papers read in both sessions were as follows:—

A Survey of Data Handling for Air Traffic Control, by J. C. Farmer and M. F. Whitney, Ministry of Aviation: *An Electronic Computing System for Air Traffic Control*, by Ir. C. G. H. Scholten, N. V. Hollandse Signaalapparaten, Netherlands: *An Experimental Electronic Data-Processing System for Air Traffic Control*, by J. S. MacMullan, H. S. Bray and J. A. Llewellyn, Ferranti Ltd: *An Automatic Radio Triangulation System*, by R. F. Cleaver, P. Sothcott and Gp Capt F. J. Robinson, Standard Telephones & Cables Ltd and United Kingdom Air Traffic Service Headquarters: *An Experimental System for Automatic Radar Target Detection and Digital Coded Plot Extraction and Transmission*, by G. L. Hinckley, Royal Aircraft Establishment: *Semi-Automatic Flight Control Using Extracted Radar Data*, by C. C. Fielding and I. G. Gibbs, Royal Radar Establishment: *Methods of Extracting Radar Data for Automatic Processing*, by N. I. Smith and B. W. Oakley, Royal Radar Establishment: *A Cathode-Ray-Labelled Plan Display*, by N. J. Smith and P. F. Hegas, Royal Radar Establishment: *Fixed-Coil Display System for Data Extraction*, by W. F. Ashton, Royal Radar Establishment.

DME Implementation Plans

THE ICAO EUMED Region meeting in Paris last month considered a DME implementation plan to which we referred in these columns on April 1. The general principles of providing DME were that it should only be co-located with VOR beacons and that the VOR/DME frequency pairing plan proposed for Annex 10 should be applied. The purpose of DME was broadly to provide improved position-fixing for departure and arrival in terminal areas for ATC purposes, particularly in simplifying radar control work. Holding and reporting points could be defined more conveniently than with NDBs and more of them could be designated. Initially, a trial plan was to be worked out and implementation would be subject to ICAO Council confirmation of DME as a standard.

Despite the tentative nature of this planning, an appendix listed the proposed DME beacons as follows (country, locations and remarks):—

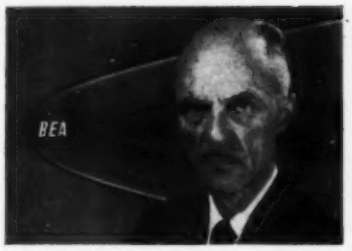
Austria, one in 1961; *Belgium*, three, plus three more later, subject to ICAO standardization; *Czechoslovakia*, will consider any standard ICAO aid, requests frequency provision for three DMEs; *Denmark*, one plus frequency provision for three more later; *Finland*, frequency provision for one; *Federal Germany*, 18; *France*, four plus three in Paris area and three more later; *Ireland*, frequency provision for two; *Italy*, 17; *Luxembourg*, one subject to ICAO standardization and operational requirement; *Netherlands*, four; *Norway*, tentative plan for four subject to ICAO standardization and operational requirement; *Poland*, four, but none before 1962; *Portugal*, two, subject to ICAO approval; *Spain*, two; *Sweden*, frequency provision for three and one test installation; *Switzerland*, two plus frequency provision for six later; *Turkey*, four; *United Kingdom*, does not intend to implement DME in UK or in any other Eumed country for which it speaks.

Significant in this list is the fact that in almost all cases the exact location for each beacon is mentioned (they have been omitted here for brevity). Also significant is the fact that Britain is the only country actually refusing to have anything to do with DMET. Poland and Czechoslovakia are prepared to implement ICAO standards.

Eurocontrol Proposals

THE Electronic Engineering Association, whose offices are at 11 Green Street, London W1, has issued a reprint in both English and French of the eleven papers read to the Eurocontrol Technical Group conference in London last month (*Flight* for April 1). The titles of the papers are as follows:—

Data Processing and Display in Air Traffic Control, by P. C. Haines, General Precision Systems Ltd; *Communication, Computation and Judgement in the Air Traffic Control Feedback Loop*, D. L. Thomas, Standard Telecommunications Laboratories Ltd: *An Experimental Electronic Data-Processing System for Air Traffic Control*, by J. S. MacMullan, H. S. Bray and J. A. Llewellyn, Ferranti Ltd; *Some Possible Applications to Ground/Air/Ground Digital Communication Systems*, by R. H. Kirkness, the General Electric Co Ltd: *A Radio Data Link for Air/Ground/Air Communication*, by R. W. Maton, Elliott Brothers (London) Ltd; *Recent Development in Secondary Surveillance Radar*, by K. E. Harris, Cossor Radar & Electronics Ltd; *Navigational Aids for Eurocontrol*, by E. R. Bonner and V. H. King, Decca Navigator Co Ltd; *Displays for Air Traffic Control*, by P. N. G. Knowles and R. F. Hansford, Decca Radar Ltd; *Applications of Xerography to Air Traffic Control*, by P. F. T. C. Stillwell, Rank Precision Industries Ltd; *Closed Circuit Television in Air Traffic Control*, by P. L. Chilton, Epsylon Industries Ltd; *Radar Remoting Techniques*, by W. L. Wright and P. N. Sargeaunt, Marconi's Wireless Telegraph Co Ltd.



Down with Mach 3

BEA's CHIEF ENGINEER PLEADS FOR SMALLER JUMPS

WELL KNOWN for his forthright views, Beverley Shenstone has committed to paper his thoughts on the subject of supersonic airliners. As chief engineer of British European Airways, his views on this topic are of singular importance; and, although he was speaking as an individual, they may be taken to represent what a fair slice of the operating community are thinking at the present time. His paper was originally read before the Society of Automotive Engineers in New York last week.

I AM speaking from the vantage point of an airline. But I am not speaking for IATA nor for any particular airline, not even my own. My own airline is short-haul, where the value of supersonic speeds is less than for longer-haul operators. I am not as yet a good friend of any manufacturer proposing a supersonic airliner. I mention all this at the start because you must wonder, when anyone talks on this subject, what axe he is grinding. If I have an axe, surely it can be no more than a little sponge-rubber hatchet, which I have so far found quite impossible to grind.

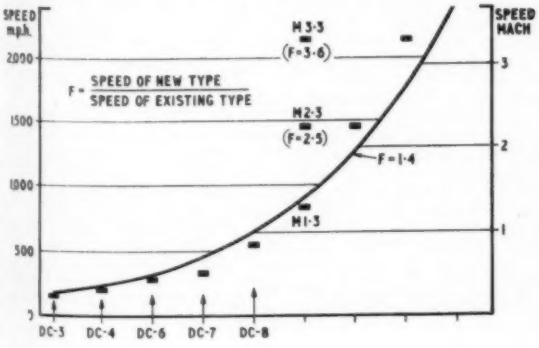
The basic approach of any airline to new things must be the business approach. We mean business because we want to stay in business. That just means that any new aircraft must not only make technical sense, be technically credible, but must also be sold to boards of directors by airlines' own engineers—and a more sceptical set of people doesn't exist. The decisions must be made by the airlines—sometimes by some airlines influencing others—but not by outside organizations, be they governments or manufacturers.

Airlines resent the *fait accompli*. Nothing annoys an airline more than to be told by a manufacturer that there is no choice but to buy a certain line of goods. This is what has been going on and it is about time it stopped. Several firms are going around saying that the only thing for airlines to buy is the M3 or 3+ airliner. Why this number? Is it really the best number for the airlines? Was it chosen for, or by, the airlines? It was not.

I have not found an airline engineer who wants M3. Who chose M3? Answers from manufacturers vary widely in shape and size. The most likely answer appears to be that the plans have to be laid to catch military orders, and the feeling is that air forces are unlikely to ask for anything under M3 if M3 is offered. It may even be true that air forces have actually demanded M3. On what basis this may have been demanded would not be known to airlines, but it could not have been on an airline basis. It has been suggested that, in order to trap the military, the Mach was pitched as high as possible by the firm making the first approaches to ensure that nobody else could go one better. This is a highly acceptable commercial technique, but has nothing whatever to do with what airlines want.

One of the big points made is that at M3, or a little higher, occurs the *One True Economy*, the balance between bad L/D and good specific fuel consumption. This I simply do not believe, considering the data available. This is a matter of assumptions and thickness of lines and hunches, and has no true engineering validity. But there are points on which I do agree. The hump at M1 certainly does occur, and thereafter things get better. But, when reaching into the unknown, it is difficult to sight along the curves with any confidence as they are so diffused and woolly. In fact, with no great technical ingenuity, one can show that the best economics occur anywhere from M1.3 to M3.5; so let us forget this special magic of M3+.

A plot of transport cruising speeds, showing the increments with which the best-known family has progressed. The factor F is the ratio of cruising speed to that of the preceding generation. The horizontal axis depicts generations, and not necessarily an even scale of time



Airlines are conservative. Whenever, in temporary aberration, they cease to be, they regret it. They have to be conservative to stay in business, and this sort of conservatism (scarred by early wildcat ventures) includes fostering all developments likely to increase business. Any step forward implies risks, but it can never be a step in the dark. One of the basic experiences of airlines is that they must have constant progression, not sprinting nor pole-vaulting. Successful airlines have so far increased speed by not more than 30-40 per cent at a time. The Douglas series is shown in the graph below because it is well-known and is widely used. Checks have been made on other series of aircraft used by airlines and the result is about the same. This curve stresses that the M3+ aircraft is a major aberration. Let us not forget that even the little increments of the past have given the airlines and manufacturers a few little problems, and my remarks here are in no way directed particularly at the firm of Douglas.

How are we, the airlines, to swallow at one gulp a 350 per cent increase in speed and, in achieving it, deal with problems of fundamental nature in structures, aerodynamics, operation and air traffic control without going broke? It is, bluntly, nonsense.

But you may retort that the old-fashioned increment of 40 per cent can no longer work because of the M1 hump. Forty per cent more than 600 m.p.h. is 840 or about M1.3. M1.3 is easier because the military data available and research on economics has shown that good aircraft, usable aircraft, can be made for M1.3. It is rather puzzling to me that in most of the present literature the idea of a transport flying at M1.3 is contemptuously discarded. The impression given is that it would be hopelessly uneconomic. Work done over the past few years has shown quite clearly that such an aircraft need not be uneconomic. The fact that it is a practical technical job may be one of the reasons it has not loomed large in literature, where there seems to be a trend toward doing things the hard way. The M1.3 aircraft can be done as an extrapolation of the classical aircraft, with either a simple swept wing or an M-wing [illustrated on page 461 last week.—Ed.].

Such schemes are examples of layouts designed to minimize wave drag in an effort to realize essentially two-dimensional subcritical flow. All the members of this classical family provide room for stowage, lifting and propulsive forces and controls in separate units. The use of such separate units is possible because we are dealing with the classical two-dimensional aerofoil flow throughout the whole flight range. The problem here is to keep interference between the various components as small as possible. This problem is, in fact, so much easier than those met at the higher Mach numbers that it hardly deserves particular attention, and certainly does not require what is sometimes referred to as a National Effort.

On the other hand, although it may be against some of the airline interests, I propose to look ahead further than M1.3 to see how far an airline dare go. No airline dares to venture too far into the dusk of the unknown at one time. Take structures, for instance, from which airlines have suffered for a generation of man and about four generations of aircraft. We now know quite a lot about light alloys, and don't want to give them up for something more exotic unless we must. Up to what speeds can light alloys be used? A few years ago we thought M1.8. Now we can design for about M2.3—a speed increase of 250 per cent over our present 600 m.p.h. Even at that speed, the cooling problem for passengers is far from negligible; some suggest that cooling might cost 20 per cent of payload, which in my opinion is more than could be afforded.

No airline can afford to operate an aircraft which is inflexible in operation. True, we are operating aircraft which are less flexible than in the past, but newer subsonic jets will regain much of the lost flexibility in the next few years. Airlines of the world (and even in America) cannot plan on moving their aircraft in predestinate grooves. In fact, we plan on deviations from plan, and off-design things demand flexibility. I mean that any practical aircraft must be able to stack at low speeds, approach slowly, and get down safely when one of a number of things go wrong. Present knowledge does not indicate that these flexibilities will be present in the M3 generation now proposed, but they can be provided at around M2.

It must not be forgotten that the aerodynamic jump between the subsonic and M2, and even between M1.3 and M2, is enor-

Down with Mach 3 . . .

mous. The classical aircraft is done for. Any attempt to retain features of the classical aircraft is a mistake, and this includes the use of a long circular-section separate fuselage. It is astonishing to me that so many of the tentative proposals made in the literature are combinations of thin wings, swept or unswept, and the long cigar-shaped fuselage. Elementary considerations readily expose the necessarily inferior aerodynamic properties of these concepts. For example, to obtain good performance and control, definite and favourable interference between the various parts of the configuration is required. A low drag for a given lift at supersonic speeds is obtained from arrangements where the lift is suitably distributed, not only along the span, but also along the available depth. This cannot be done with a typical near-circular fuselage.

In addition, the concessions necessary for supersonic operation which lead to reductions in wing thickness and aspect ratio indicate that such a classical layout also loses its superior low-speed characteristics, and that we have to do something quite different to maintain the same type of airflow throughout the flight range. At these speeds, it is no longer practicable to use the principle of subcritical flows to avoid large amounts of wave drag. We must recognize that drag dependent on lift includes a wave-drag term, which becomes smaller as the chord of the wing increases [illustrated last week.—Ed.].

Balancing this against the vortex drag which becomes smaller as the span increases, we arrive at the basic supersonic lifting surface representing the natural solution in the same sense that the unswept elliptical wing of large aspect ratio represents the natural subsonic solution. In addition, the wave drag due to thickness also becomes smaller as the length of a given volume is increased. Thus, the possibility arises of integrating the volume with the lifting surface which is the basis of the slender-wing aircraft, where the means for providing room for stowage and lift are integrated into a shape with subsonic leading edges and supersonic trailing edges. This layout employs a new type of flow, with vortex-sheet separation from all edges throughout its flight range. This concept, which is probably necessary for the M2 aircraft, is applicable through the range to M3. The more this type of aircraft is studied, the more convenient it appears operationally. The only serious problem appears to be the problem of the rolling moment due to yaw at low speeds.

New Materials

Here we have forced upon us this enormous aerodynamic step into the unknown. If, in addition, we make just as fundamental a jump in material, having to discard our light alloys, we are suggesting something which will make life very difficult for manufacturers who want to sell something to an airline.

That doesn't just mean a change of material. It is not something that a manufacturer can do on his own. He needs more design data which means research. The material problem is not just a matter of ordering the right gauges. There are processing and metallurgical problems unsolved. Consistency of product in physical properties for large sheet sizes may well be a major snag. To get consistently large *flat* stainless-steel sheets on a production basis for the gauges required has only been tried, and not yet done because there has been no demand. It is far from easy. It would certainly be welded and not riveted, remembering how difficult it is to work stainless steel. This is too much for airlines to swallow until there are many military hours on such structures.

It is perhaps on the engine problem that airlines are most disturbed for M3. The engines will have to be entirely new to obtain the efficiencies needed; in particular, the intake problem is very difficult, even at M2. There are unsolved problems of temperature and fatigue in the M3 engine, the solution of which may well increase costs considerably. In some of the assumptions made in the literature, the engine has been assumed to cost no more to buy or overhaul than existing turbojets. I think this is highly optimistic. These engines will have to withstand very much higher intake temperatures. Although mechanically they may be somewhat simpler than present-day two-spool by-pass engines, they are bound to be more expensive to buy because of the exotic and expensive materials needed. As a result, they may inherently have a lower overhaul life. Since airlines will demand at least as good an overhaul life as at present, the attainment of this may make the engine even more expensive to buy, or alternatively, more expensive to overhaul because of a high rate of parts-replacement. On the other hand, M2 requires only an acceptable extrapolation for the engines, the main problem being efficient intake design. The Hustler bomber at M2 is no help in this, for its intake efficiency is by no means so demanding as that for a commercial vehicle.

Let us be clear: The M2 and M3 transports have practically nothing in common, except perhaps superficially. The development outlays are not of the same order. It is unwise to assume that on the basis of a cancelled M3 bomber, the information gathered can be transferred across to an economical civilized aircraft. To prove an M3 transport would need maybe three times the testing and flying needed for the M2. One of the main rumours floating about is that nobody should build an M2 transport because it would be quickly outclassed by an M3 transport. This is the big bogy-man. It is this suggestion that has implanted the necessary fear in the minds of some airline executives in order to make them act. Again, I do not object to this good commercial technique. I only say that there are no grounds for this fear. If in 1934 you had been offered the DC-3 in a couple of years and had been told that the Constellation would be available five or six years later, would you have waited for the Connie, about 50 per cent faster? You would not. I think people forget that life is logarithmic but that time is not. Twenty-five years ago, five years was a long time to us; but now it seems nothing because we are all so very much older. But five years is just as long as it was, and more money can be earned in that time than could be earned 25 years ago. People are saying, "Although someone could produce M2 for service in, say, eight years, in a few years more the M3+ could be built and run the earlier machines off the map." These figures imply orders given now, and if you fall for that you show your age.

Certificated or Certified?

If I were an airline and had chosen to order an M2 transport and my competitor had decided to order M3, I would be the happiest airline in the world because I would know from all the research done to date that I would have years and years of operation without serious competition. I would watch my competitor's development costs climbing. I would watch his rubberized delivery dates stretching and, with some concern, I would see the manufacturer regretting his first assumptions on break-even production numbers. The weight of cooling and conditioning equipment would rise as time went on. Long drawn-out arguments with the Authorities would take place on passenger-safety requirements and structural integrity. While I was certificated, my competitor might become certified.

There is another very interesting aspect to this propaganda. It was clear that many of the airlines which bought subsonic jets must operate them for many years before they can afford to buy anything new and faster. This fact has been made the excuse for suggesting that, since nobody can buy anything until 1970, they should not buy M2 but M3, on the assumption that by waiting so long they will in effect have missed the M2 level out. This is a peculiar argument, because if the M2 machines are never built they cannot be missed; and there does not seem to be any more reason to get much faster machines at a later date because you did not get different machines at an earlier date.

Who are our competitors? If none of us has the machines, whom are we fighting? I am sure you will retort and say that we are fighting the Russians, and probably they are working hard on some sort of supersonic transport. It will have to be in a very different technical category from the existing Russian jet transports, if it is to be of any competitive interest to us in the Western world. This again is the fear factor. If we do something solely because we think that somebody else might be doing it—somebody else who is not directly competitive with us—we may be doing a very stupid thing, unless that development is what we need commercially.

The Lack of Quantitative Data

We have all read, I assume, the papers written on this subject over the past few years. There is one outstanding common factor to all the higher-Mach proposals—a lack of background data which an airline operator can use to make his own analysis of the aircraft. You dig through the papers and they tell you a great deal of great interest. They tell you that the direct operating cost per seat-mile is as good as this or better than that, but they never tell you just how much it is going to cost or, if they tell you what is the cost, they don't tell you how big it is or to what extent development costs are included. It may well be that these costs are simply not known, or that they are so enormous that one hesitates to mention them, or that it is assumed all development costs would be covered by military orders. They would, therefore, not be relevant to the commercial problem.

If these facts are withheld because they are not known, it is rather puzzling that manufacturers are so confident that the direct operating costs of these machines would be competitive with existing aircraft. Typical of what I find disconcerting in the present pseudo-literature is the mention of certain problems in such a way as to give the impression to the pseudo-technical reader that the problem may not be difficult, when we know full well that it is extremely difficult. Take proving flying, for instance, at M3: it might require something like 20,000hr, which might well cost $60,000,000. This is not the sort of money that has been bandied about in any of these papers. You may get up in a body and say

(*Concluded at foot of page 537*)

A Proteus is disgorged at Nairobi. Africargo services operate London - Frankfurt - Malta - Khartoum - Entebbe - Nairobi and Salisbury. An unscheduled extension is made to Johannesburg. Traffic rights are also held for services to West Africa

A northbound Fiat 600 is fork-lifted aboard at Nairobi in three minutes by an experienced handling team

ANYTHING TO AFRICA

THE new British United Airways services to Africa will include, under the well established and happily joined trade-name "Africargo," the all-freight operation developed by Hunting-Clan Air Transport. Here are some impressions of this service as gained by an unusual type of load—a passenger.

"FLIGHT" PICTURES AND STORY BY J. M. RAMSDEN

NOT many passengers get the opportunity to fly on an all-freight service. It is true that in December 1956 the fattest man in the world, Robert Earl Hughes (1,041lb), was air-freighted by Slick Airways from Illinois to New York. And a very enjoyable flight he had, too, judging from the publicity photographs. But his was a special case (no pun intended), quite different from that of the *Flight* staff member who recently had the good fortune to accompany a Hunting-Clan DC-6C *Africargo* service.

We have had more comfortable flights, but few more interesting or unusual ones. The experience was, in an unexpected way, exhilarating: this was air transport at its most utterly unglamorous. The normal air transport world of speed, luxury, prestige, flag-wagging and nice fat mail subsidies was all around. But sealed off in our DC-6C, with our feet up on a crate of pharmaceuticals, and the sniff of a neighbouring pig in our nostrils, we felt comforted by the sanity of air transport's Cinderella sideline.

There was straw on the wooden-planked floor, the windows were wire-meshed, and a pool had appeared beneath a Labrador's box (even though the flight assistant had taken him out for his mandatory walkies three hours before at Khartoum). And as we walked up front to talk to the crew, a hand reached out and grabbed our trouser leg. It belonged to a monkey; bored with his carrots and tomatoes, he screamed with ecstasy every time someone passed his cage.

Past a Fiat 600, whose owner had flown on ahead for his six months' leave in England. On farther, past a BOAC Britannia's Proteus powerplant, then another (at about £600 each or 4s 9d per kilo, from Salisbury to London). Every bit of volumetric capacity, it seemed, was packed with stuff.

Name anything, pretty well, and at some time or another it has been by Africargo. Our manifest read like the inventory of a crazy collectormaniac—with the difference that each item was needed urgently by somebody. It was costing someone so many shillings a kilo to send, and the number of those shillings—and no other kind of revenue—meant the difference between profit and loss for the carrier.

You do not get rich quick, if ever, on air freight. This is said so often that you wonder why anyone bothers. After four years (from 1955 to 1958 with Yorks), HCA are just beginning to see returns on the money that they have put into the Africargo service. They now use the best available aircraft for the job, the DC-6A convertible—otherwise known as the DC-6C—with the big door and the heavy duty floor. Sabena did the conversion for HCA: upholstery is retained, and a quick-to-fit galley is always at the ready, because HCA's two aircraft are used for trooping and, especially in the summer, for inclusive tours.

We saw that the DC-6A, as everyone in the business acknowledges, is not the ideal aircraft for freighting. At Nairobi it took a team of 15 men an hour and a quarter to off-load a Proteus. With rear-loading doors and a roller belt it would have been out before you could say CL-44. And many of the less heavy consignments would have been whisked out on to a lorry even before the arrival of the Sikh whose brilliant solo on the fork-lift truck left us aglow with admiration. He and the native manhandlers admittedly embarked the Fiat 600 in about three minutes flat. But by then we knew what the US all freight carrier Riddle Airlines meant when it said that half its direct costs were due to ground labour force and equipment charges. Meanwhile shouts of "left a bit . . . steady . . . whoah . . . back a bit . . ." etc., symbolize air freighting's marginal economics.

But, as we have said, HCA are using the best available aircraft. As we sat on a dog kennel in the sunshine at Nairobi Embakasi watching HCA's loading team in action, thinking how much simpler and quicker and hence more economic it would be to have rear loading and integral rollers, we appreciated that the DC-6A has compensating advantages. It is cheap to buy. HCA bought their two aeroplanes new off the Douglas line in 1958; even so, a freight carrier can buy a used DC-6 passenger version today for £100,000 and convert it to freighting (big door and heavy floor) for another £100,000. So for £200,000—a fraction of the cost of a new specialist all freighter, you have a ten-ton-payload aircraft that is proven, cruises very smoothly at 250-300kt, costs about £150 an hour, is quickly adaptable to passenger-carrying, and can operate economically with full-load stages of anything from 300 to 3,000 miles. Which is good value for money. And unless freight operations are at high intensity, which they are not on HCA's Africargo run, the ground handling time is not such a vital economic factor.

So perhaps the imperfect loading qualities of such aircraft as the DC-6A do have to be balanced against these compensating advantages.

We must now record some impressions of our 18 hours aboard HCA's DC-6C G-APNO. The crew was a "24 hour" team of five, comprising three pilots and two engineers. The law which lays down flight-time limitations sets the total time for which a crew may be on duty at 16 hours, and the Africargo schedule, which calls for a crew slip at Khartoum, is more economically and conveniently operated by a 24 hour crew than by a 16 hour crew comprising two pilots and one engineer. Our team (depicted in the photograph) were, the skipper said, no different from any other inasmuch as they regarded all-freight flying as just another job: the fact that the payload was "dead" (not counting the livestock) rather than alive made no difference to the prescribed standards and regulations that had to be adhered to. They thought the world of the DC-6, which was "an absolute joy to fly," especially after years of operating Yorks. The longest technical delay that the skipper could recall after a year of operating the DC-6C was two hours at base caused by a faulty ground-air valve in the airframe de-icing system. One of the engineers said:

From left to right, F/O D. W. Owen: Capt R. L. Bartley, DFC; F/E O'Leary; F/E B. Arscott; S/O J. R. Hounsfield

ANYTHING TO AFRICA . . .

"The engines just keep on going, up and down the route, and we have never had any trouble with them."

All the crew were agreed that the radar (Bendix RDR-1, the same set as fitted to HCA's Viscount 833s) was "even more essential on a freighter than on a passenger aircraft." The reason for this was that it is no fun at all flying into rough weather that might cause heavy loads to come adrift from their lashings. Some hairy stories were related of pre-radar days. One night a car broke loose from its lashings in a particularly violent storm and caused some anxious moments as it banged against the side of the aircraft. On another occasion a York was hit by hail which so distorted the carburettor intakes that one Merlin stopped and power was lost on the other three, with the result that £5,000 worth of electric shavers had to be jettisoned over the Mediterranean. (On another occasion our skipper had had the unpleasant and perhaps unique experience of having his York's windscreen shattered by a bird at 8,000ft *at night*.)

Apart from the safety advantages of radar, the cost of making wide detours around storm areas could, in our crew's opinion, justify the expense of a radar set probably within the first year of its operation on a route like that served by the Africargo service.

There was for us a curious novelty about flying again in a big piston-engined transport, since in recent years most of our experience has been of turbine operations of one kind or another. The engineer was rapturous in his praise of the exhaust gas analyser, "which can tell you at a glance which plug in which cylinder is faulty," thus saving perhaps five hours with cowlings off on the ground.

Up front we watched the co-pilot making gentle detours round cunims by adjustment of the Sperry autopilot. "This is a wonderful George," he said, and he certainly appeared to be enjoying himself. We noticed that as we flew into cloud that the engineer never took his eyes off the BMEP (brake mean effective pressure) gauges which, with r.p.m. set, determine the horsepower used. (Hunting-Clan use 1,100 h.p. constant power for cruise.) Quite suddenly there was a clatter of hail against the windscreen, and aerodynamic noises from the top of the canopy as the VHF aerial alternately collected and shed ice. We noticed that No 2 BMEP gauge lost 50lb/sq in as the carburettor intake momentarily iced up. The engineer switched on the switch marked "airfoil icing," and he continued to watch closely the BMEP and carburettor intake temperature gauges. The skipper meanwhile peered into his scope and "steered round the brilliant returns" on autopilot. Soon we were in clear skies again *en route* for Ndola, where HCA's handling team awaited the arrival of the Bushing 330kV outdoor transformer we had aboard for the Kariba Dam project.

We met for the first time on this Africargo flight a crew member known as a flight assistant. Just as a stewardess looks after the passengers, so the flight assistant is responsible for the payload on an all-freight operation. "It cannot be too strongly emphasized." reads the Hunting-Clan handbook on the subject of flight assistants, "that you are responsible in every sense of the word for what happens to cargo at transit stations. It is your decision as to what to do under all the different circumstances that may develop. You must supervise loading, off-loading, trim, keep an eye on pilferage and you must never leave the aircraft during loading." This handbook includes addresses of all available veterinary surgeons down the route and it states that "the most severe disciplinary action" will be taken if there is any omission in the keeping of each animal's "progress record."

Hunting-Clan are widely known for their expertise in air-freighting animals; and the flight assistant, as we have explained, certainly has to be an animal lover. Among his qualifications are a course of training by the RSPCA, and on our typical flight he was in sole charge—for 24 hours—of half-a-dozen dogs, a couple of cats, some monkeys, a pig and hundreds of tiny, endlessly chirruping tropical birds. Each quadruped is in a box, the dimensions of which must be a prescribed function of the animal's dimensions. To each box is attached the aforementioned progress record.

We got the impression that the flight assistant's job is not suitable for people who like to have the occasional time off to relax in the course of a long 24hr flight. There are no flight-time limitations applicable in his case. As well as feeding, watering and inspecting his livestock, he has to prepare snack meals for the crew (and any passengers who might be on board). He is at his busiest when the aircraft is on the ground. Not for him the leg-stretching walk over to the airport terminal for a cup of coffee: he has to clip leads on all the dogs and take them out for a walk, which can be quite a strenuous experience, as we ourselves discovered.

At Nairobi we took aboard a full load (10,000 kilos plus), most of it as usual bound for London. It is not so easy to fill up northbound as it is southbound—or, rather, it is not so easy to fill up with the better revenue-rate loads. Obviously the manufactured goods consigned from Europe to Africa are in a different commercial class from the return loads of the pineapple type. This is why rates northbound are in general much lower than those for the southbound, main-traffic-flow direction.

Yet we could not take aboard all that was offered at Nairobi without exceeding maximum permissible take-off weight on this occasion (45,654kg, fixed by runway length using 20 degrees of flap). The lower-priority stuff that was left behind (mainly company freight) would go on the next day's Safari service. Though the Africargo service is once-weekly only, in practice—passenger loads permitting—the associated HCA colonial coach Safari flights do enable a good frequency of service to be offered to the freight shipper down the African routes.

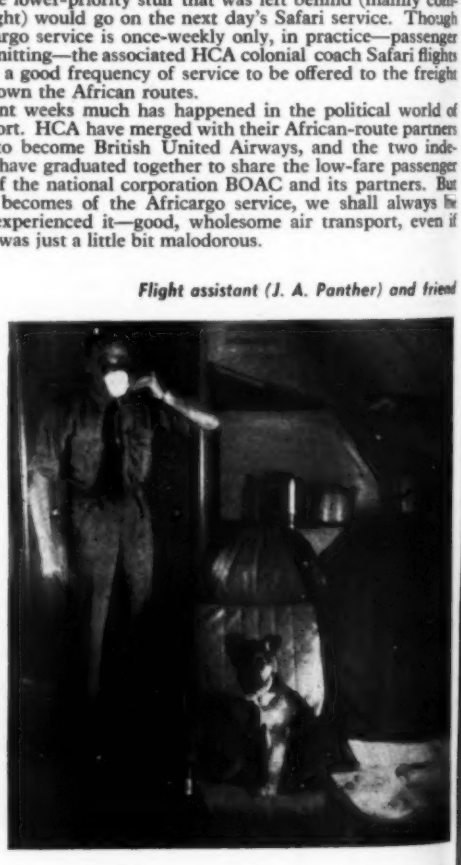
In recent weeks much has happened in the political world of air transport. HCA have merged with their African-route partners Airwork to become British United Airways, and the two independents have graduated together to share the low-fare passenger markets of the national corporation BOAC and its partners. But whatever becomes of the Africargo service, we shall always be glad we experienced it—good, wholesome air transport, even if the cabin was just a little bit malodorous.

AFRICARGO SERVICES

Year	Aircraft Type	Capacity short ton-miles x 1,000
1955	Yorks and Vikings	1,904
1956	Yorks	3,876
1957	Yorks	6,273
1958	Yorks and DC-6Cs	6,750
1959	DC-6Cs	*

*Approximately a ten per cent increase over 1958. It is estimated that a load factor of 70 per cent was achieved in 1959.

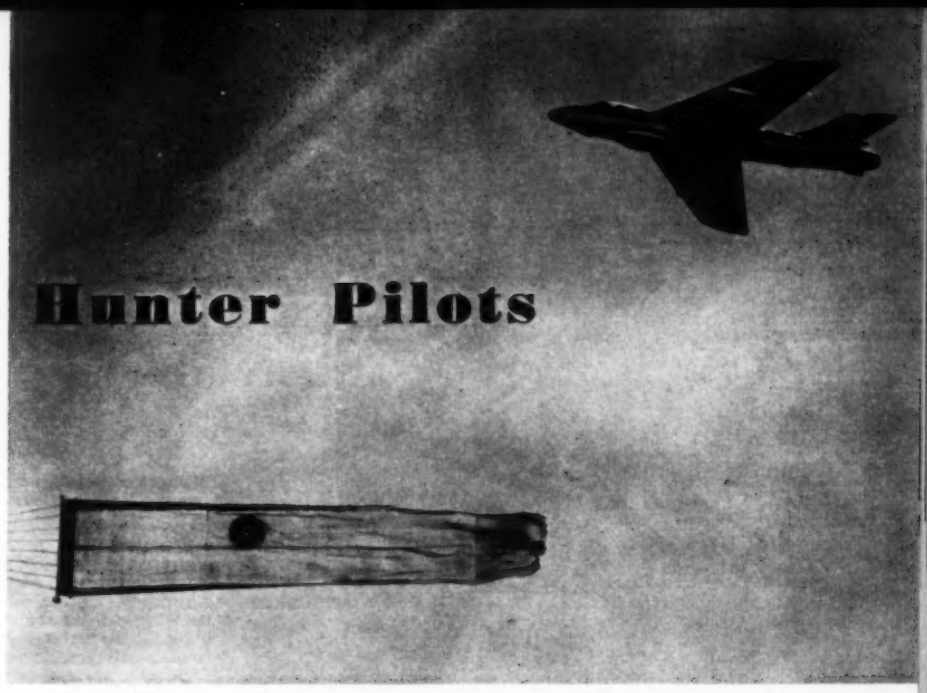
Flight assistant (J. A. Panther) and friend



Training Hunter Pilots

FIGHTER COMMAND'S DEVON-BASED OCU

BY HUMPHREY WYNN



"FLIGHT" PHOTOGRAPHS

WHEN R. T. Boyd started North Devon Airport in 1934 he could hardly have foreseen that the gentle buzz of his D.H. Moths and Dragon would in the 1950s be replaced by the thrustful roar of Hawker Hunters. Yet so the whirligig of time has dealt with this airfield near Barnstaple Bay. Begun as a base for the enterprise sonorously called "Lundy and Atlantic Coast Airlines," the original field is now part of RAF Chivenor, where Fighter Command's day intercepter and ground attack pilots are trained.

This permutation from trips to see the puffins to training in combat techniques would not have been achieved but for the Second World War, which brought the grass airfield under Air Ministry control. It also brought the RAF to Chivenor (a name taken from a local village) in 1940; and the original North Devon Airport, on land which belonged to Heanton Court Farm, was sucked in when the eastern boundary of the airfield was extended the following year. Considering its civil ancestry, the fact that RAF Chivenor now lodges the Puffin Aero Club seems historically right: the club's Magister, Auster and Aerovan occupy a hangar in one corner of the airfield.

On the other hand, it might seem historically oblique that Chivenor should be a Fighter Command station after having for so long operated under Coastal Command, two of whose AOCs-in-C (Air Marshal Sir Edward Chilton and his predecessor Sir Bryan Reynolds) were wartime station commanders there; but its geographical situation, well away from any airways or control zones (Chivenor is the most westerly of Fighter Command airfields), makes it an acceptable base for training in fighter aircraft and there is a good local weather factor. Whether its usefulness will continue with the introduction of Lightnings is another matter; for a local liability is that its main runway could only be extended out into the Taw estuary.

Chivenor's commanding officer, Gp Capt P. O. V. Green, with two of his wing commanders. On his right is Wg Cdr P. J. Anson (Wg Cdr Flying) and on his left Wg Cdr A. W. Horne (Wg Cdr Administration). The OC Tech Wing, Wg Cdr J. T. Main, was on leave when this photograph was taken. In the heading picture, a Hunter F.4 pulling away after attacking a sleeve target symbolizes No 229 OCU training

No 229 Operational Conversion Unit has been training pilots on Hunters since May 1955. Before that it was equipped with Sabres (for a short time) and before that with Vampires. It is the only unit at Chivenor, apart from a detachment of No 22 (ASR) Sqn, and the station and OCU are commanded by Gp Capt P. O. V. Green. He has held this appointment for only just over two months, since completing the RAF Flying College course (on Hunters and Canberras) which he took on returning from Ceylon. Chivenor is organized on the usual three-wing basis, and the officers responsible are Wg Cdrs P. J. Anson (Flying), A. W. Horne (Administration) and J. T. Main (Technical).

Architecturally, the station still has very much a wartime look, with domestic buildings of a uniform single-storey style. Were a setting required for a 1940s film, Chivenor would provide it after the removal of a few TV masts. But well-kept gardens enhance the station's atmosphere, and apart from a hideous power-station on one skyline the surrounding countryside has all the varied charm of sea-coast, river and hills typically associated with Devon.

A staff of about 90 officers, 500 airmen and some 200 civilians man the station, and to it come three main streams of pilots for training on Hunters and in Hunter emergency techniques. In addition there are occasional individual conversion or refresher courses.

The full course lasts three months, and the number of pilots on it varies from nine to 12. They come to Chivenor possessing different levels of experience: at the time of *Flight's* visit there were two squadron leaders on the course, one of them destined to command a Hunter squadron, and several young flying officers who had no previous operational experience. Some were Cranwell graduates, some had been taught to fly in Canada under the NATO training scheme. But whatever the background of a pilot coming to Chivenor, the training he receives there is impartially comprehensive, and by the time he leaves no aspect of Hunter operation should be foreign to him.

There are three sides to training at the OCU—flying, ground instruction and emergency procedures. Flying is carried out in Hunter F.4s and two-seater T.7s, backed by Meteor 8s which are used for target-towing. Flying training is organized by two squadrons, under the command of Sqn Ldrs A. R. Keys (No 1) and E. S. Chandler (No 2), and is closely linked with ground training—the responsibility of Sqn Ldr P. J. Chambers.

Comprehensive instruction is given on the Hunter's powerplant and controls, weapons and safety equipment. In the engine lecture-room is a sectioned Avon (skilfully prepared on the station), in the weapons room a radar ranging gunsight. A cockpit mock-up has been made, showing all controls with the exception of flying controls; a G4F compass is demonstrated and explained. Another important aspect of ground instruction is the discussion

Simulator and emergencies training at Chivenor. From left: Flt Lt R. Smith at the control console of one of the simulators; Sqn Ldr B. Byrne with a [illegible] shown the Martin-Baker ejection seat by Flt Lt Batt (at right of the group); and parachute training being given by Sgt Thompson, one of

TRAINING HUNTER PILOTS . . .

of Hunter tactics, which are illustrated diagrammatically (students are subsequently given a project to work on during their course); and all the aircraft's safety equipment is explained and demonstrated.

Hunter emergency procedures are indoctrinated at Chivenor through the use of three simulators built by the Air Trainers Link Division of General Precision Systems. On these machines, every type of instrumental and mechanical failure can be deployed by the instructor. During our visit, a pilot doing max rate (0.9G) descending turns was subjected to the loss of his artificial horizon. This quickly resulted in the aircraft becoming inverted, but the pilot recovered by the correct use of his other instruments. In the same way, emergencies like the failure of powered controls or a flame-out are simulated realistically; and tactical information is supplied for interception training.

One of the three simulators at Chivenor represents a Hunter F.6 cockpit (it incorporates part of an actual aircraft fuselage) and the other two F.4s. All the machines have self-checking circuits and a warning-bell rings immediately if anything goes wrong mechanically. Pilots on the three-month course do 17 one-hour periods, five of them before going solo on Hunters: thus simulator experience is closely co-ordinated with flying training. There are 17 exercises, ranging from familiarization and instrument landing procedures to (for example) No 14, when the instructor says "Climb up to 40,000ft if you can"—proceeding to make the accomplishment difficult by feeding-in failures and complications. All nine instructors in the section, which is headed by Sqn Ldr B. Byrne, are Hunter pilots.

A similar link between flying and ground instruction persists in safety equipment training at Chivenor, which is the responsibility of Flt Lt J. K. Maddison and Flt Lt B. B. Batt; for they again are Hunter pilots, with first-hand knowledge of the procedures they teach. All pilots going to No 229 OCU are instructed in emergency and survival drills, whether they are taking the full course or the short one (a three-week Hunter conversion), or have come from squadrons specifically for the five-day HSE (Hunter simulator and emergencies) course. As far as ejection, for example, is concerned the instruction covers not only proper operation of the Martin-Baker seat but also correct parachute landing technique. This is taught in the gymnasium, with appropriate equipment—three suspended harnesses, and a ramp and a chute to provide pre-landing practice—under the keen eyes of qualified PJIs (parachute jumping instructors).

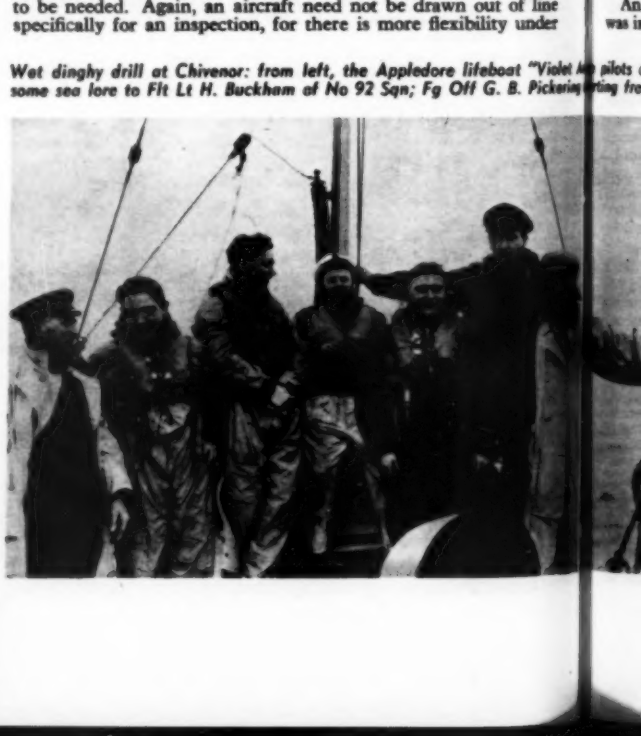
Landing in the sea is practised with absolute realism at Chivenor, through the assistance of the Appledore lifeboat, whose co-operation was secured after the local Marine Craft Unit ceased to operate. Early every Thursday morning the boat takes about six pilots out into the estuary and there, suitably garbed in protective clothing or immersion suits, they jump into the sea and inflate their dinghies. Time for inflation varies from about 15sec to a full minute; and the practice is made even more realistic if the sea is at all rough. Fortunately the sea was calm when we made a sortie with Flt Lt Batt and three squadron pilots.

The second stage of this wet dinghy drill is recovery by helicopter, a Whirlwind of No 22 (ASR) Sqn picking up the pilots either by winch or scoop as they bob about in Barnstaple Bay. (This is one occasion, after the Thursday rescues have been effected, when the Royal Air Force allows itself an official rum ration.)

All this ground training supplements an intensive flying programme at Chivenor, its 32 Hunter T.4s and ten T.7s accomplishing an average of six sorties per aircraft per day—a high utilization rate which prompted Wg Cdr Anson to comment, "You can't say there are any surplus machines."

This high utilization is secured partly by means of a staggered take-off procedure, and even more so through the progressive servicing system which is employed at Chivenor. Under it, some of the times when an aircraft is due for an inspection may be anticipated, and the work done when the machine does not happen to be needed. Again, an aircraft need not be drawn out of line specifically for an inspection, for there is more flexibility under

Wet dinghy drill at Chivenor: from left, the Appledore lifeboat "Violet [illegible]" pilots [illegible] some sea lore to Flt Lt H. Buckham of No 92 Sqn; Fg Off G. B. Pickering [illegible] fro



Portsoys; Flt Lt D. J. Curtis, a student on the short course, being
Photographs illustrating this article were taken by Ian Macdonald

this system than there was under the old one. Under it, too, ground crew are deployed as economically as possible; all communication is by microphone, as it is throughout the station.

Another aspect of Chivenor's servicing organization is the close liaison between aircrew and technical personnel, signified physically by the use of a combined operations room. Further, in each of the two Technical Wing squadrons (under Wg Cdr J. T. Main) are two pilots, Flt Lts A. R. Thomson and R. T. F. Snare, who look after 1st line servicing and attendant groundcrew. In addition to their ground responsibilities they carry out testing of the unit's aircraft, so have a first-hand knowledge of serviceability standards.

Everything at Chivenor is concentrated on the Hunter, in teaching pilots to fly it under all conditions and indoctrinating the latest Fighter Command interception techniques. As a result, there is a noticeably young and enthusiastic air about the station, a sense of drive and keenness. This is shared by foreign pilots at the station, which includes three Lebanese students and an American (Capt D. A. Pogreba) and a Dutch instructor (Capt Fritz Giebel), the latter the son of a former Chief of Staff of the RNAF. Whatever may be said about Chivenor's architectural drabness (an inheritance from its wartime past) can be offset by commendation of its keenness. The latest enthusiasm at the station is for Go-Kart racing, and with a runway to spare (only the main 2,000yd one is used for jets and the second-longest for piston-engined types in cross-winds) there should be good scope for the sport.

Gp Capt Green spoke of his station's place in the local community, both economically—as an employer of labour and consumer of goods—and socially. Relations were excellent, he said, as evidenced by the co-operation of the Appledore lifeboat and references to the Whirlwind as "our" helicopter. As to the future, it looked as though Chivenor would go on as long as there were Hunters in RAF service. In local flying, special efforts were always made to keep the noise-level to a minimum.

An excellent history of the station has been compiled, and it was interesting to study it in the office of Flt Lt B. M. Burley (who has been largely responsible). References to a Hart as the first RAF aircraft to land in the vicinity, when on a photographic survey of Exmoor in 1935, and to Blenheims and Beaufighters of Chivenor's first operational squadron (No 252), made ghostly reading for a spring day in 1960, with the whine of Avons in the sunshine outside. The station's wartime history was linked with Coastal Command; but in post-war years it has been playing a sound role in training pilots for the jet-age Fighter Command.

Overseas officers at Chivenor. From left, Capt F. Giebel (Dutch), Lt J. Chehayev (Lebanese), Capt D. Pogreba (USAF) and Lt J. Cortbawy (Leb)

Flt Lt R. Lawrence in the station's model aircraft section with his flying replica of the Fairey Rotodyne

'Violet' pilots on the HSE course with members of the crew (the coxswain, Sidney Conn, is on the left of the group); the coxswain propounding
Pickering getting from the lifeboat; and (next picture) being assisted aboard after the non-appearance of the helicopter owing to unfavourable weather

NO 117 OF OUR "IN THE AIR" SERIES: MARK LAMBERT AND ALASTAIR PUGH TRY THE CESSNA 150, 175 AND 210

CESSNA CIRCUS

LAST November we flew three of the Piper light aircraft now being imported into this country and prepared a multiple handling report (*Flight*, November 13, 1959). We then decided that the range of Cessna aircraft now being imported by Airwork Services Ltd, of 35 Piccadilly, London, W1, should receive the same treatment—and here is the result of our joint handling of the little 150, the 175 tourer and brand new, potent 210.

An Airwork sales drive is now getting under way and no fewer than four assorted Cessnas were sold to British customers in one recent weekend. A big demonstration and sales session was held ten days ago and prospects for the wide range of Cessna types in Britain appear rosy. Particularly interesting is the strong rivalry now developing between the Pipers, which were first on the scene in strength, and the Cessnas. In fact the various types are not quite directly competitive and both prices and performance are dovetailed rather than overlapped, as the ensuing reports and data (on page 537) will help to show.

Outstanding qualities of all the single-engined Cessna variants are all-metal construction, excellent undercarriages and a surprising variety of gorgeous paint schemes and luxurious interior finishes. Almost every type can be fitted with the Tactair T-2 or T-3 vacuum-operated single axis or two-axis autopilots and a very extensive range of extras such as optional seating, head- and arm-rests, cargo tie-down rings, lighting, oxygen, almost any radio, and various instruments. Airwork are providing full spares and service backing, with engine overhauls to be done by Hampshire Aviation and a guaranteed 72-hour spares delivery service direct from Wichita. Airwork are also providing sales and service for many of the American light-aircraft radios. There appears to be no reason why the number of American business aircraft imported into Britain should not be twice as high in the coming year as it has been in the past year.

Flying with us in all three types was Joe Tyszko, an exceptionally experienced test pilot who is now Cessna sales manager for Airwork.

Cessna 150 We decided that despite a dreary mist which merged into eight-eighths cloud at under 1,000ft we should get airborne and do what we could, starting with the smallest and working up. We each flew the aircraft below cloud with Joe Tyszko; but, as the 210 was equipped with full radio and ADF, we took this machine into the clear and then made a radio compass let-down straight on to the runway. Gathering of any quantitative information was extremely difficult in such weather.

The little two-seat trainer/tourer 150 is a remarkably attractive machine. It is economical, has pleasant handling qualities and a surprising turn of speed and is cleared for spinning. The average English student pilot would be delighted to learn to fly in its comfortable, well equipped and quiet cabin. Anyone trained in the 150 would have no trouble in dealing with the average single-engined American business aircraft. He might develop what the "old heads" would call good hands, but we cannot help feeling that a little extra tuition would be required after an upbringing on the rustic unbraked, unsteered, tailwheel or skid types common here. Unfortunately, the 150 is not aerobatic, but it is selling like hot cakes in the US and could do just as well here.

The cabin is properly furnished and a choice of upholstery colours is available. Ashtrays, cigarette lighter, cabin heater, ventilators, navigation lights and other mod. cons. are standard; so the 150 serves equally well as a business aircraft. The standard version is fully furnished and has single controls, the trainer has dual controls and additional extras, and the plush Inter-City Commuter is a really smooth little transport. The last-named has a 35A generator so that extensive radio can be carried. All three variants, of course, have toe-operated disc brakes and steerable nosewheel.

Access on each side is by a car-type door which clips back against a wing strut. The only seat adjustment is by tilting the back-rest, but this effectively locates the pilot. The brake toe-pedals are easily operated and the wheel brakes themselves are very powerful and have good sensitivity. Nosewheel steering is light and accurate and can command a very tight turning radius. Beyond this, individual brake will castor the nosewheel. Behind the seats is a "slit trench" to accommodate 80lb of baggage or a miniature seat for children. The 150 we flew was a trainer with a few optional extras.

Upper picture, the smooth little 150 trainer/tourer with 100 h.p. engine. Below it is the four-seat, 175 h.p. 175 tourer. Both types have excellent sales prospects in Britain

The rectangular, finger-contoured control wheels emerge on pistons from the main panel and a single throttle plunger lies between the two wheels. Engine starting is up to best American standards. The two 13 US gal wing tanks feed together through a single on-off cock but have individual contents gauges. An interesting safety point is that the lap-strap buckles are on the inboard straps so that it makes virtually no difference if one pilot inadvertently picks up the other pilot's belt.

Taxying with a trickle of power, the 150 at once feels smooth, steady and light. Visibility over the nose and to the wing tips is unobstructed but, because the pilots sit well back beneath the wing and the roof is "solid," high-wing limitations apply to upward visibility. The standard take-off is made clean with trim neutral and the 150 has no swing; it unsticks at between 40 and 50 m.p.h. Speed builds up rapidly to 70 m.p.h., at which the rate of climb has risen to 700ft/min. Take-off to 50ft requires 400yd.

Though the low ceiling severely limited our activities, at about 100 m.p.h. it was immediately obvious that the 150 is a pleasant little aeroplane, very responsive and with light control forces. Controls were nicely harmonized and the noise-level low enough to permit conversation with only slightly raised voices; but this did make a certain amount of vibration rather more noticeable. The cockpit was a snug fit at shoulder level. On this damp, murky day all the Cessnas we flew had a strong tendency to mist up their windows, but the ventilators in the wing roots could be directed on to the windscreen to help clear them. Both the 150's side windows could be hinged open about their top edges to provide direct vision and a copious flow of fresh air. The exhaust-muff heater was switched on during taxying and proved so effective that its output had soon to be considerably reduced.

In line with Cessna characteristics, lateral stability of the 150 was high, so that yawing produced virtually no bank. A certain amount of rudder was needed to co-ordinate a reversal from left to right steep turns. Rapid reduction of power produced a gentle and gradual nose-down trim-change and extension of flap only a slight further nose-down change. The elevator trimmer was low-geared but very precise.

Cessna are proud of their "Para-Lift" flaps, which extend rearwards and then downwards, forming a big slot between the wing and the nose of the flap. Actuation is by a central, floor-mounted lever with four positions, the last of which is equivalent to an air-brake setting. With full flap, a power-off approach at about 70 m.p.h. can be made at a quite startling downhill gradient so

that it is virtually impossible to overshoot a normal airfield even if you cross the boundary at 1,000ft. Lambert said he could hardly see an everyday use for so much drag, but Pugh thought it might be very handy in certain conditions. With three-quarter flap and power off, Lambert trimmed the 150 at 55 m.p.h. and then applied full power, hands-off. The nose came up quickly, but a light forward pressure served to hold it down. In this condition there was precious little climb and flaps would need to be much reduced for a quick overshoot.

At 700ft he was able to stall the 150 safely, the speed when clean being about 40 m.p.h. i.a.s. Speed falls off slowly, the stall warner bleeps and, following a brief judder, the full stall develops with a firm wing-drop. Aileron control remains until the last minute and recovery with the nose lowered is almost immediate. Pugh found that steep gliding turns with incessant stall-warning bleeping at about 55 m.p.h. did not readily produce a stall; but it was no day for too much of this sort of thing.

For landing, three-quarter flap produced a 1,000ft/min descent with excellent forward visibility. Elevator and rudder were precise but well over 90° of aileron wheel-movement was required to counteract very gusty air. Nevertheless, quite adequate response was available so that the touch-down and float required only light control forces, and could be exactly judged. Like all the single-engined Cessnas, the 150 sits much lower on the ground than one expects, but it drops on to its springy undercarriage firmly, with no inclination to bounce. Steering and powerful braking are immediately available.

On the ground, despite a 12kt wind 30° off the runway, we noticed virtually no weather-cocking, and lateral stability was excellent. In that wind one could waggle the wings with the ailerons and lift and lower the nose while taxying at walking speed. We had not before seen an aircraft with such control response at virtually zero speed; it was the more surprising to note the virtual absence of unpleasant wind effects on the ground. We agreed that the 150 could have a big future in Britain both as trainer and touring aircraft. For the former purpose there might be only one limitation, that of poor upwards and rearwards visibility; but there was so much else which would make the affluent but not-so-young business man a willing and satisfied student pilot or air traveller. It is, after all, to this type of member that the clubs may now look for lucrative custom.

Cessna 175 Next we sampled the sleek and gaily-painted 175, one of the 145/175 h.p. group of four seaters with cruising speeds in the 130 to 140 m.p.h. bracket. This is an altogether larger and more purposeful aircraft than the dainty 150; stability and control harmonization are quite different and with its much more pronounced longitudinal stability fairly firm stick forces were required when power or speed are reduced.

The 175 has the geared engine giving 175 h.p. instead of the ungeared 145 h.p. of the basic 172. The Skylark is the de luxe, lavishly equipped 175 h.p. version. All three have a spatted nosewheel undercarriage and that gracefully swept fin which is *the* styling gimmick for 1960—a flashy piece of aerodynamic licence but one which seems to have no effect on control.

The 170 series has the usual range of equipment with such transatlantic luxuries as cigarette lighter, individual ashtrays, cabin heater, six ventilators, suit hanger, adjustable seats, key-operated ignition, windscreen defroster, navigation lights, map pocket, steerable nosewheel and toe-operated hydraulic disc brakes as basic features. The Skylark, the most luxurious of the three, is painted all over whereas only styling motifs are applied to the natural metal skin of the other two.

From the point of view of visibility, the occupants are better distributed in the 170s than in the 150. A car-type door on either side gives on to the middle of the cabin for access to the adjustable rear bench seat. The front seats can be slid right forward and their backs tilted down. They can be slid back again to favour the pilots, but the normal sitting position for the latter is with the seat well forward and the legs reaching downwards rather than forwards to the rudder pedals. The pilots are thus almost within the bowed windscreen transparency and the high-wing effect on visibility is very considerably reduced. Instrument-panel layout, with dual control wheels and central plunger throttle, is good, leaving flight instruments in front of the first pilot and plenty of room for radios. The fuel gauges on the far right are not easy to read accurately from the left-hand seat. Fuel flow from the two 21 US gal wing-tanks is controlled by a single on-off cock on the floor between the seats and the big, four-position (10°, 20°, 30°, 40°) flap lever and elevator trim wheel were also on the floor between the pilots.

Smoothly styled interiors with "all mod. con." are Cessna features. This is the 180, very similar inside to the 175

We found that engine starting had motor car simplicity and that taxying visibility was excellent. The undercarriage gave a smooth, steady ride with spring-connected nosewheel steering giving a radius of turn sufficient for all normal manœuvres. Really tight turns—comfortably within the 30ft width of a taxi track—could easily be made by using the toe brakes, which were light, responsive and very powerful. After braking hard for some time we found that the brakes tended to fade, probably because the spats slightly hampered cooling, but they were still adequate for turning about a wing-tip.

Take-off and climb were short and quite straightforward and, cruising at about 120 m.p.h., the elevator trim was very low geared but could be exactly set. Lateral stability was very high, so that application of rudder caused little bank and rudder co-ordination was required when entering and reversing turns. Noise level was low, visibility was quite good (there are no roof windows in any of the high-wing Cessnas) and the ride very steady. Longitudinal stability was fairly high requiring firm back-pressure during prolonged turns and when reducing power or speed.

Whereas the 150 stalled properly, with buffet and a fall-away, the 175 could barely be stalled at all; it tended rather to develop a smooth sink with the nose still high—an innocuous performance accompanied by the bleeping of the stall warner. Although the stall itself developed at something just over 40 m.p.h. i.a.s. a 700ft/min sink developed at about 50 m.p.h., but we were still able to explore the stall without danger at some 700ft above ground.

The flaps are again the extraordinarily effective Para-Lift type whose full extension allows a precipitate rate of descent. Each successive setting caused a firm nose-up change which could be easily eliminated by trimming. Application of full throttle, hands off, during a trimmed power-off glide with three-quarter flap produced a nose-up pitch which could be comfortably held by forward pressure, and a transient climb of 800ft/min was available without raising the flaps. Approach and landing were completely straightforward on a wide variety of approach angles. Maximum aileron deflection was achieved with over 90° of control wheel-rotation and a firm back-pressure was required after the throttle was closed, but plenty of elevator remained for the round-out and a precisely controlled float. Both pilots again tended at first to round-out high (the top of the spat is about 2ft below the level of the pilot's seat), but the 175 dropped firmly on to all three points and showed no tendency at all to bounce.

Painted all over and with many extras as standard, the Skylark is the de luxe version of the 175

The 210 cockpit with full blind-flying panel, ADF, VOR and VHF. Hydraulics are below the vernier engine controls in the centre. Most of the switches are push-pull knobs and the instrument layout appears virtually standard in all Cessna types

CESSNA CIRCUS . . .

Good points about the 175 are luxurious comfort, sound control layout, excellent ground handling and a totally innocuous stall. Points which Lambert felt an owner would have to get used to are the piloting position, which feels at first to be almost standing up and the need to co-ordinate turns with rudder because of high lateral stability. At 70 per cent of its 175 h.p. the 175 cruises as fast as *Flight*'s Gipsy Major Gemini, uses less fuel, carries a much greater load and flies farther—and is infinitely more comfortable and easier to manage on the ground. But we must add that we have yet to find any American business aircraft with anything like the classical handling qualities of the Gemini at favourable c.g. position.

Cessna 210 Next to the 170 series are the tailwheel 180, nosewheel 182 and the "super custom" Skylane which Cessna call "the mighty middle line." All three have 230 h.p. engines, a 70 per cent cruising speed of about 160 m.p.h., maximum range of over 800 miles and a take-off run of 555ft. The tailwheel 180 seems to be attractive mainly for its rather shorter landing run and greater suitability for utility or bush-type operations.

Both the 170 and 180 series are traditional Cessna designs which have been modified for 1960 mainly by the addition of the splendid "flight/sweep" swept fin. Only the tailwheel 180 and the little 150 now retain the traditional vertical fin. The 210, on the other hand, burst upon an astonished market some time last year and is still remarkable for its retractable nosewheel undercarriage and curiously down-turned wing-tips.

From the pilot's point of view it is a very different aircraft from any of the others. It has a hydraulic system for flaps and undercarriage, a rudder trimmer, fuel pressure-control for its direct-injection engine and cooling gills which have to be set for take-off, climb and cruise. It also has rather greater capacity for radio and additional systems. It is little bigger or heavier than the others but much faster and has greatly improved handling characteristics—which one might expect from a more recent design. Undercarriage retraction is very quick and neat and the cover doors close when the gear is down, leaving no gaps or openings.

The aircraft we flew was one of the prototypes which is making an extensive European tour. It is fitted with Narco Mk 5 VHF, Sun-Air HF and Lear ADF. The Continental IO-470-E is controlled by throttle, pitch and fuel-pressure plungers (the latter replaces the usual mixture corrector); all are vernier controls which can be released to slide freely by pressing a button in the head of the plunger. A useful feature of the 210 and other Cessna types is a knob on the panel which, when pulled, causes the fuel filter cup to drain to atmosphere and thus eliminate any accumulated water from the lines without one having to open the cowling.

The two 32 US gal tanks in the wings must be separately selected and fuel pressure should be set to the correct value for a given height or r.p.m. setting, appropriate values for per cent of cruise power being marked on the fuel pressure-indicator dial but more accurately calculated with reference to outside air temperature by means of the circular slide rule, supplied with the aircraft. The ventilators, heater, reclining seats and headrests, ashtrays, even oxygen plug-in points and so on make the 210 no less plush than its brothers, but the rather larger instrument panel rises higher and forward visibility is not quite so good as in the smaller types. The hydraulics, with controls in a neat console between the pilots, are carefully arranged so that the wheel-shaped undercarriage lever must be pulled out and pushed against two distinct stops to operate the undercarriage in either direction. It clicks back to neutral when the operation is complete. The aerofoil-shaped flap lever is spring-loaded to return to neutral and the flaps can be inched to any degree of extension. A telescopic handle can be extended from beneath the panel for manual operation of the hydraulics, but it can be moved only when hydraulic reservoir-pressure has been dissipated. The fuel selector and trim controls are on the floor between the pilots.

Engine starting is routine, and on the ground the 210 is stable, smooth and quiet. The rudder pedals are rather more loosely spring-connected to the nosewheel so that more than gentle turns require use of the toe-brakes, but the latter again are light and extremely effective. Lambert found the vernier throttle a pleasant means of controlling power both on the ground and in the air. It might be a question of taste, but he thought it would be particularly handy to use, for instance, during a long power-on approach. Pugh wasn't quite so sure; he found it hard to strike a balance between over-sensitive push-pull action and furious rotations for smaller adjustments. But the three vernier controls together do allow extremely precise setting for cruise control.

When we climbed into the 210 the ceiling was still about 700ft and visibility on the approach was less than a mile. Cloud-top was reported as about 5,000ft, so we decided to use VHF and radio compass to climb above it, make a few tests and do a radio compass let-down. Lambert had the first go and took off to fly for a few minutes below cloud to get the feel of things. He noticed immediately, as Pugh did in turn, a surging acceleration on take-off and a very steep climb at about 1,400ft/min. The nose was so high that the climb was virtually made on instruments and he had to level off smartly to avoid entering cloud.

It was at once apparent that the 210's controls were much better co-ordinated than those of its predecessors. Although lateral stability remained high, use of rudder alone produced a smooth progressive bank and, although a very useful rate of roll was available, the wings would remain level for minutes on end during hands-off flight. Co-ordination of turns with rudder was much easier and lighter than with the 175 and the control forces in general seemed to be a fraction lighter. With a cruising power setting of 2,200 r.p.m., 22in manifold pressure and 71b/sq in fuel injector pressure the speed readily built up to 156 m.p.h. Throughout the flight Lambert could not quite accustom himself to flying at such speeds in a high-wing aircraft—a reaction which surprised him. Visibility in turns was about as good as that in the 175.

Full flap can be extended at about 100 m.p.h. and with about two-thirds flap Lambert trimmed the 210, power off, at 60 m.p.h. Elevator trim is low-geared but can be exactly set; we both thought highly of the proportional quality of this control. Lambert then applied full power hands off, and established that the strong nose-up tendency could be held quite comfortably and that despite the great drag of the flaps—some 200ft/min of climb was still possible. Raising the flaps caused no apparent sink.

Until now we had been rushing around below cloud in the available 700ft of murky airspace and using the Lear ADF to criss-cross over the western locater beacon for the Blackbushe 08 runway. We decided now to climb through cloud, starting eastwards from Blackbushe; but before going up Lambert lowered full flap, closed the throttle and tried to simulate that precipitate Para-Lift approach. Before we had established ourselves in the descent we were well into a Stuka attack on the control tower, so

The 210 has an excellent turn of speed and is pleasant to fly. Clean underside and braced wing with turned-down tips give it a distinctive appearance in flight

The 210 undercarriage on the way up gives the impression of the results of an extremely heavy landing. Retraction is very quick

he had to break off and settle down into the instrument climb.

Although blind-flying instruments are sometimes poorly arranged in American business aircraft, those in all the Cessna types follow a reasonably standard pattern, conforming to the American practice of putting a.s.i., directional gyro and horizon on the same level. This is, of course, contrary to long-established RAF practice and Lambert found it necessary to concentrate hard to keep up an effective general scan.

Soon after entering cloud it was noticeable that a good deal of right rudder was required to keep straight. The rudder trimmer was effective in correcting this, but rather insensitive. At climb power we forged upwards at a good rate, soon turning northwards to avoid the London Control Zone. All the time, that convenient ADF needle pointed to the locator beacon. The windscreen became covered with dense moisture and we emerged from an indistinct cloud top at about 6,000ft into an intense glare from reflected sunlight. After crossing the beacon Lambert tried a series of turns and then set about a stall with undercarriage and 20° of flap down. The speed dropped off steadily and the nose came well up, but adequate aileron control remained until the last moment. No sink built up short of the stall, as it had done on the 175, and we eventually mushed gently into a straight stall with the nose well up and the stick just reaching the aft limit. The stalling speed was below 50 m.p.h. i.a.s.

Approaching the stall the wing-mounted warner peeped plaintively and a slight judder announced the onset. So far the 210's behaviour was impeccable, but Lambert, having some height to spare, continued to hold the stick hard back and after a second or so the left wing dropped sharply and we entered a steep dive. Recovery from this was immediate with the controls centred and he could then apply power to level off again. There is therefore a slight bite to the 210's stall, but a pilot would have to push it to get that far and should then be able to recover without difficulty.

Again we flew back to the beacon and followed a race-track holding pattern while a DC-3 climbed out below us. We then began the let-down on the westerly leg, lowering the undercarriage and 10° of flap at 160 m.p.h. With some power we went downhill at 140 m.p.h. and 1,000ft/min. Some 10° of flap may be lowered at such relatively high speeds so that plenty of drag is available to make a steep let-down without throttling right back.

Under instructions from Joe Tyszko (who was also working out the fuel-pressure settings that this up-and-down flight entailed) we then made the procedure turn to the inbound leg and, as a dreary gloom closed about us, levelled off at 2,000ft. With virtually no change of power setting the 140 m.p.h. let-down turned smoothly into level flight at 100 m.p.h. and by simply increasing speed to 140 m.p.h. we were able to continue down to 700ft, at which point we again made contact with the ground. Some time after passing the beacon we saw the high-intensity approach lights and applied three-quarter flap and motored down on to the runway. During the final approach power was adjusted only with the vernier control which gave a steady approach gradient.

Even after sitting in the rear seats while Lambert was performing these exercises, Pugh was a bit taken aback at the apparent fierceness with which the 210 accelerated down the runway and rushed into the climb. It will not fly off by itself and it is easy to reach climbing speed with the wheels still on the ground.

As this was the last sortie of the day (time and weather were pressing) Pugh stayed at about 600ft and within sight of the airfield perimeter. These were narrowish margins in which to sample the urgent 210 and the temptation to treat it like the big aeroplane it feels was considerable. But while the acceleration was very marked it was equally easy to shed speed when necessary, because of sensibly high lowering speeds for wheels and flaps and the constant-speed propeller. At the forward c.g. position at which Pugh was flying the ability to hold a trimmed speed made the approach very reassuring. As flap was progressively lowered until the 210 seemed almost to be standing on its nose, this characteristic increased, so that an approach at a steady 80 m.p.h. was really no sweat at all and Pugh gradually became used to the idea that this was quite a little aeroplane after all.

That 40° of Fowler-type flap was too entertaining not to use, but the flare-out is then considerable and—as the 210 sat low on the ground—both pilots found a tendency to level off a bit high.

In the 30° cross-wind the touch-down, at about 65 m.p.h., was like that of the other Cessnas, with plenty of control and no tendency at all to bounce or swing.

The British pilot is, we think, taught about perfect flying characteristics in very imperfect aircraft. In American business machines he is liable to find handling characteristics which fall short of ideal but an exceptional standard of comfort and ease of operation. Real snags in American light aircraft—and there are very few—are shown up only when they are used for other than A to B travelling. Lambert said that he was quite happy to put up with most of the apparent imperfections if only he could guarantee to be able to climb in, press the starter, light a cigarette and take part in the gracious airborne living of the American sales brochures. Pugh likes his creature comforts too, but what an opportunity is being missed (he remarked) of producing a British aeroplane combining the best of both worlds.

CESSNA AIRCRAFT DATA

Cessna 150 (Continental O-200-A, 100 h.p.) Span, 33ft 4in; length, 21ft 6in; gross weight, 1,500lb; empty weight, 946lb; max recommended cruising speed, 70% power at 9,000ft, 121 m.p.h.; max range 630 miles; initial climb, 740ft/min; service ceiling, 15,300ft; take-off run, 680ft; price in UK, about £3,600

Cessna 175 (Continental 175 h.p.) Span, 36ft; length, 26ft 4in; gross weight, 2,350lb; empty weight, 1,339lb; max recommended cruising speed, 70% power at 10,000ft, 140 m.p.h.; max range, 755 miles; initial climb, 850ft/min; service ceiling, 15,900ft; take-off run, 735ft; price in UK, about £5,300

Cessna 210 (Continental IO-470-E, 260 h.p.) Span, 36ft 6in; length, 27ft 4in; gross weight, 2,900lb; empty weight, 1,735lb; max recommended cruising speed, 75% power at 7,000ft, 190 m.p.h.; max range, 1,100 miles; initial climb, 1,300ft/min; service ceiling, 20,700ft; take-off run, 740ft; price in UK, about £9,900

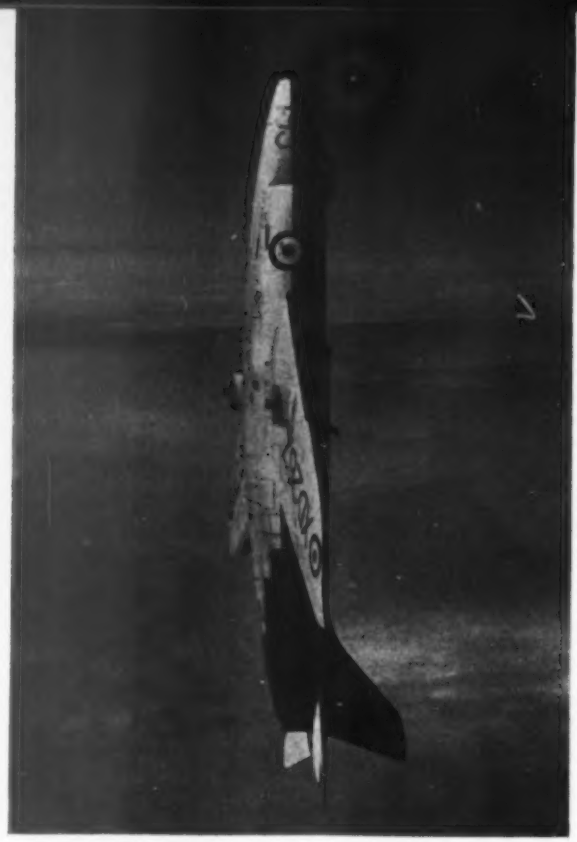
DOWN WITH MACH 3 (continued from page 528)

that 20,000hr is most unrealistic. It may be, but the fact is you do not know, and pretending to plan positively on ignorance gets us no place.

In reading the literature, it is clear that most of it is an essay in "One-Upmanship" and much of it tends to be high-grade advertising material, which brilliantly hides what is unwritten. Outstanding among the cards held close to the chest is the layout of the aircraft. It is realized that it is essential to withhold one's good cards from one's competitors, but since you all know that you are doing this and the airlines know that many of the proposals must be misleading for this very reason, the validity of the literature suffers severely. Take, for instance, the aircraft shapes so widely discussed and so unlikely to be real. For M2 to M3 the integrated slender-wing configuration is never mentioned. Since it is the only one that happens to be unmentioned, one can assume on the principles of operational research that this is the most likely layout intended.

Probably I am underestimating the cunning of the manufacturers, especially those who talk so easily about M5 to M7. May not this huge public relations and deceiving-the-enemy battle mean that manufacturers hope to divert the competition into the more impossible Mach numbers, so that they can quietly and quickly produce a satisfactory M2 aircraft in light alloy, with the minimum of extra problems and a life long enough for any airline?

You will gather that I suspect that M3+ aircraft will be found unsatisfactory if taken in one jump. So we shouldn't jump. None of us can afford to bring any supersonic aircraft into service before the early 1970s, but I suggest that even if you reach no further than M2, airlines should now begin to collaborate with manufacturers while there is still time for airlines to get what they want, instead of having to take what is available. On the other hand, there won't really be very much available because of the extraordinarily high development costs. My guess is that there might be only two—and at most three—alternative aircraft suitable for airline operation in the West. With so little room for manœuvre, it is the duty of airlines to themselves and to their customers to ensure that the all-round result is the right one. And the right one is the one to keep us in business.



A Scimitar F.1 of No 807 Sqn "Flight" photograph

Flying the Scimitar

SOME LIVELY IMPRESSIONS BY A PILOT

THIS excellent account of handling the Vickers-Supermarine Scimitar twin-Avon fighter/bomber, both in the air and on the deck of a carrier, is reproduced from "The Vickers Magazine." The writer is Lt J. W. Beard, RN. In the same issue of the journal appears a detailed account of the design and construction of the new carrier HMS "Hermes."

AT present forming at RNAS Lossiemouth is the squadron, armed with Vickers-Supermarine Scimitars, which will shortly embark in *Hermes*. The first Scimitar unit, No 803 Squadron, was formed in 1958 and embarked with eight aircraft and nine pilots in the Vickers-built carrier *Victorious* in September of that year. In spite of early difficulties, to be expected when operating a new and complex aircraft from a new ship, the Scimitar came through the often gruelling tests of actual sea service with flying colours. The Scimitar proved itself to be a thoroughly reliable, robust and versatile aircraft and has earned the unqualified admiration and confidence of the pilots who fly it. The squadron now forming will benefit from the accumulated experience of No 803 Squadron—the pioneers.

To tell something about flying the Scimitar it is as well, first, to say something about the aircraft itself. The Scimitar, the fastest and most potent aircraft yet to enter service with the Royal Navy, is 54ft long, has a spread span of 37ft and the tip of the fin stands 17ft above the deck. Twin Avon engines gulp air down two cheek intakes and combine to give 22,500lb thrust.

The aircraft stands on a conventional tricycle undercarriage whose oleos are of massive proportions, and there is a no less robust tail-skid to protect the after end during catapult launches or landings at excessive attitudes. Equally sturdy is the hook, which is fitted at the apex of a retractable "A" frame the members of which would well serve as railway lines. Buried in the capacious, whale-like fuselage are four 30mm guns, and four universal pylons project beneath the wing, for the carriage of 200gal drop tanks, or any type of weapon up to 2,000lb per pylon. The whole impression is of a massive, robust and thoroughly aggressive looking machine.

The cockpit is comfortable and roomy; the general layout is excellent and all controls come readily to hand. Instruments are easily read, with the exception of the compass which, by tradition, is placed behind the stick. With the aircraft in the static position, the pilot's eye is some ten feet above the deck, and in the landing attitude this is increased to something approaching twenty feet above the hook position. Visibility is slightly restricted by high cockpit coamings and by the windscreen frames which, in keeping with the rest of the aeroplane, are massive. However, it is perfectly adequate for normal deck landing purposes.

One of the more impressive sights at sea today is that of a Scimitar squatting at an attitude of 12° on the catapult, waiting to be launched. Pilots accustomed to the less extreme habits of Sea Hawks and Venoms understandably tend to view the whole performance with some apprehension at first. However, it looks more forbidding than it feels and the launch given by steam boosters is considerably smoother than was available with the earlier hydraulic systems.

A speed up to 100-105kt is attained by the end of the 165ft track and once clear of the booster it is important to maintain incidence, particularly when under-wing stores are carried. Any loss of attitude will cause the aircraft to descend. Flap-blowing is always used for catapulting, since this markedly improves the longitudinal handling. Having cleared away the undercarriage and flaps, the initial climb is spectacular and performance thereafter, lively. The pilot can satisfy his curiosity about a passing vapour trail remarkably soon after take-off.

Like the catapult launch, the business of deck-landing a Scimitar looks considerably more dramatic than it feels and, provided it is treated with the respect due to a sophisticated aeroplane, the Scimitar is a pleasant deck-landing machine. Aircraft join the circuit in pairs from astern, flying down the starboard side to break at fifteen second intervals. The downwind leg is established at 800ft approximately a mile on the port beam of the ship and, with everything down except fuselage flap (not forgetting to make the flap-blow switch) airspeed is reduced to between 160-165kt. The deck does undoubtedly look small from this position, in spite of the extra area bestowed upon it by 9° angle. Such space as there is appears to be entirely filled with aircraft, deck-landing machinery and hurrying people.

The turn on to finals is made when about abreast the stern. At the 90° point the mirror comes reassuringly into view as an amber blob and, with the height of 600ft, speed 10kt above the touchdown speed for the weight, everything is set for the final approach. The pilot's concentration is now entirely given over to the accurate obedience of the mirror, small airspeed corrections, and to lining-up with the angled deck—all of which factors are critical. The pilot has time just to note, with slight surprise, that the deck—or that portion of it which is reserved for landing—is, after all, clear.

If the mirror is correctly obeyed, the hook will clear the round-down by about 9ft and engage the second or third of a niggardly total of four wires. With such a small hook clearance, it is easily appreciated that by flying only slightly low on the mirror there is a definite and unpleasant possibility of snatching the hook out altogether, by engaging the solid ironmongery of the roundown instead of a wire. Alternatively, the result of approaching too high may be a "bolter" or, for the pilot who has his pride to consider, an uninhibited last moment push forward on the stick in a desperate effort to catch a wire. The resulting rate of descent may well break even the robust oleos of the Scimitar. In such cases it is better to abandon the approach altogether. Deceleration, once a wire is caught, is rapid, but not unpleasant, with a pull-out distance in the order of 250ft as a rule.

Conditions are not, of course, always ideal: for instance, the ship may be pitching fairly violently and this will require the pilot to interpolate a mean of the mirror signals. Several factors may, individually or in combination, reduce visibility drastically. Funnel haze, for example, not only reduces visibility but causes considerable turbulence. Salt deposits on the windscreen—or rain—may reduce visibility to practically nil, particularly when the ship happens to be steaming up sun.

Having stopped, it remains for the pilot to get out of the wires as rapidly as possible, to clear the deck for the next aircraft. The landing interval aimed at is 45 seconds, a limit imposed by the time taken for the wires to reset. Aircraft are parked with wings folded in that noisy, windy and crowded part of the deck forward of the island known as Fly One. A series of marshallers direct the aircraft into this space under the hypercritical eye of the Flight Deck Officer.

Taxying on a moving deck, particularly when the ship is pitching, can sometimes be a confusing experience, made no easier by the unavoidable presence of scattered patches of kerosine/sea-water emulsion, when the brakes are poor, if not useless. To make maximum use of the very limited space available, aircraft must be parked within inches of each other and to achieve this wheels are run out to the extreme deck edge. When parking right forward, this means that the cockpit may well project out over the bow of the ship and there can sometimes be an unpleasant illusion of brake failure when the parking brake is selected. The pilot, who can only see the sea rushing past below him, sometimes forgets for a ghastly moment that the ship and not the aeroplane is moving. All things considered, there is a need for much vigilance.

Straight and Level

DO you remember the old statistic that more people are kicked to death by donkeys in America than are killed in airline accidents? Well, American donkeys have not yet reached the peak of their savagery. At a recent press conference an aide of Gen J. D. Caldara, the USAF safety expert, chipped in with the remark that twice as many people are now kicked to death by donkeys in America as are killed by the airlines. Not just *more* people, *twice as many* people.

By my reckoning, therefore, no fewer than 514 Americans were kicked to death by donkeys during 1959. How many others, I wonder, have met the man who keeps the donkey-kick fatality statistics?

Dressing-gown diplomacy: from left to right, Duncan Sandys, Minister of Aviation; William Woods, chairman of one of the London Airport residents' associations; John Connell, founder of the Noise Abatement Society. See story below

● Sixty London Airport residents, protesting against the decision to allow night jet flights, roused the Minister, Duncan Sandys, from his bed at 7 a.m. (or perhaps they really intended it to be 7.07).

They probably hoped he would be absolutely livid—as livid as they are when jets crackle thunderously over their chimney pots in the small hours. But they were disappointed.

"Good morning everybody," he said pleasantly as he appeared on his doorstep clad in silk dressing gown, pyjamas and slippers. He waved-off a trio of hopeful-looking policemen, chatted for 20 minutes or so (politely declining the offer of one demonstrator to play a record of a jet taking off) and concluded with a cheery wave: "Goodbye, and thank you for coming."

The noise protesters quietly dispersed, having made their point but not quite sure whether they had won it.

One noise sufferer has suggested that Lord Douglas, chairman of BEA, should be the next to be roused. Then Sir Gerard d'Erlanger of BOAC—and why not all the UK managers of the dozen foreign airlines who operate, or intend to operate, night jet services out of London? It looks as though a new era of dressing-gown diplomacy has been ushered in.

● The attention of Cunard's publicity manager has been drawn to a misquotation of his chairman, Sir John Brocklebank, in this column on April 1. I reported Sir John as follows:—

"We have always maintained that if anyone carried a single person across the Atlantic it ought to be us, not BOAC."

What Sir John actually said, the publicity manager assures me, was:—

"We have always maintained that if anyone carried a single person across the Atlantic it ought to be us, *unless it were* BOAC."

My italics, and my apologies.

● Agency message from New York: "Audiences will be sprayed with tulip perfume in a musical show to be staged by KLM The Royal Dutch Airlines in the 74 countries it serves to introduce its new DC-8 pure jet service. . . . Corinne Rottschafter, of Amsterdam, the reigning 'Miss World,' will be the star of the show during a tour of the United States and Canada which has opened here. It includes dramatic, comedy, and singing performances, and films."

They'll be taking people for aeroplane rides next.

● A few weeks ago Boeing put out a story about a nuclear engine they had invented. In principle it works like this: the reactor is mounted in a ship (surface or submerged) and fed with water under ram pressure, and the resulting water and steam provide a propulsive jet. Such a unit is virtually a hydraulic ramjet, but L. J. McMurtrey, who thought it up, says you can also insert a rotating assembly of compressor and turbine to turn it into a water turbojet. Submarine speeds of 100 m.p.h. are said now to be possible, and the whole idea has been taken to an advanced stage and made the subject of a patent application.

Two things stem from this. The first is that Boeing, the world's biggest producer of aeroplanes (in terms of weight or cost), are diversifying harder than ever. The second is that this is the first end-product to come out of the "think tanks" of the company's Advanced Design section at Wichita. I published a picture of one of these cells on January 1; they consist of four walls, each about 6ft long, enclosing a desk, chair, scribbling pad and sharpened pencil. I have often wondered what sort of things would come out of these thought-inducers; now I know that a man-powered spacecraft is just a matter of time.

● A colleague was talking the other weekend to a distinguished British test pilot. They got on to the subject of the airmanship of airline pilots, and I quote the test pilot's remarks as worth disagreeing with:—

"When I was demobbed from the RAF I came into the industry with the feeling that the airline pilot was much superior to the Service pilot. This belief was first shaken somewhat when I saw emerging from a foreign airliner at London, his four rings gleaming splendidly, a pilot I had to transfer from my squadron to Army gliders. My experience since has convinced me that, generally speaking, the Service pilot is a better airman."

I suppose one retort to this is that most airline pilots are ex-Service anyway. And I have always been tremendously impressed—no flannel—with the meticulous airmanship of British civil aircrew. But there it is: you have my word for it that the test pilot concerned is greatly respected by all the piloting fraternity. It is his considered opinion that Service pilots are better than airline pilots.

● The fascination of small-arms is world-wide, but in America the cult of the hand-gun and rifle is a religion, especially among Servicemen. Thus, at one of the big gunnery meets the victor wins the title of "Top Gun." Vulcan, the astounding six-barrelled aircraft cannon, which fires between 4,000 and 6,000 rounds of 20mm ammunition a minute, has been called "six-shooter of the jet age." And the B-52 was described on its first appearance as "the long rifle of the air age."

It was of a B-52 operation that a *Time* reporter wrote recently: "Pilot Bulli finished his part of the check list, made sure that his 40lb of printed manuals were in place, stowed his .357-cal Smith & Wesson Magnum near his seat. Finally, he put a sign in the windshield. It read 'COCKED'."

The B-52's warload, I find, was a Magnum too—a "multi-megaton bomb . . . equal in force to ten Atlas ICBMs, or to the sum of all the bombs dropped on Europe by all the Allied planes in World War II."

This B-52 is one long rifle that had better not go off at half-cock.

ROGER BACON

Australia's Airline Policy an Economic Success

By STANLEY BROGDEN

IF the acid test of a Government's civil aviation policy is the economic health of the airlines concerned, then the well-established two-company policy of the Australian Government can fairly be assessed as an accomplishment perhaps worth the study of the United Kingdom Government. That an anti-Socialist Cabinet should approve and maintain a policy of complete balance between a State-owned operator and one fully capitalist is in itself an astonishing phenomenon, but surprise is all the greater when one considers that the policy is proving, economically at least, most successful.

When the shareholders of Australian National Airways Pty Ltd decided, on August 28, 1957, to accept an offer by Ansett Transport Industries Ltd of £A3,300,000 for all its assets, ANA was in a bad state. There is no question that the company would have collapsed if the offer had not been accepted. Morale was at the lowest possible ebb, for the staff were working from day to day without the certainty of work tomorrow.

ANA had scented trouble as long ago as 1945. On July 4 the Federal Government (Labour) brought down legislation for a Government monopoly. When the Australian National Airlines Act (August 16) was given assent, private operators challenged it in the courts. The High Court agreed (December 14) that the Commonwealth did not possess the legal power to create a nationalized monopoly of airline services, but it also allowed that the Government had the legal right to establish its own airline. The Australian National Airlines Commission then went into business as Trans-Australia Airlines, opening operations on September 9, 1946. ANA's application to the High Court of Australia and the Privy Council for an appeal was knocked back. TAA stayed in business.

When Labour lost the 1949 Election many Australians saw the demise of TAA as certain, but to their surprise the Liberal-Country Party Cabinet retained TAA. The concensus of opinion was that TAA was running the better airline. At that time ANA (1950) was flying 258,584,000 revenue passenger-miles and 12,722,279 freight ton-miles, while TAA's figures were 262,056,500 and 6,971,723 respectively.

In 1952 the Government formulated its policy of maintaining two trunk-line operators in Australia, largely with the object of maintaining competition. There was then no third operator who could challenge the two giants or which could finance a take-over of TAA for private enterprises.

On November 18, 1952, the Civil Aviation Agreement Act was given assent. By this the Government and ANA agreed to a 15-year contract by which ANA would be guaranteed an immediate loan of £3,000,000 for the purchase of new aircraft and which (this was a most contentious political point) granted ANA equal access to all the airline business available in Government departments, hitherto practically a TAA monopoly, as well as an equitable share in mail contracts—Labour had given TAA preference there. As private airlines had recently challenged in court the right of the Department of Civil Aviation to levy air-route charges, the agreement provided for the Government to take over some £300,000 of the £900,000 which ANA owed. Ansett Airways were given a similar helping hand and TAA made a book entry.

The Act legislated for the appointment of an independent arbitrator to determine any matter in disagreement between the two operators. The Director-General of Civil Aviation (now Donald George Anderson) was appointed.

At that time Ansett Airways were a minor factor, but when ANA and TAA increased fares by 15 per cent in October 1947, and Ansett did not, the third force began to be felt on trunk routes. A few months later the two big fellows had to reduce the fares on routes on which Ansett operated. Ansett then followed a policy of offering tourist fares, and their share of the trunk route business increased month by month.

ANA, like Ansett, was developed by the genius of one man—Sir Ivan Holyman, whose death seriously affected the company. But ANA had made serious errors of judgment. They had been slow to appreciate the public reaction to the introduction of pressurized aircraft (Convair 240s) by TAA in 1948 and they backed DC-6s against Viscounts (Ansett introduced 340s) because they believed the Douglas aircraft could carry more freight. ANA found that Ansett's smaller but more aggressive operations were biting hard. Ansett did not take business from TAA's Viscounts, but from ANA's DC-6s and DC-4s. There was no room, however, for a third airline on the major trunk-route system. Only TAA could profit.

In June 1957 ANA (or, rather, the shipping interests which held the ANA shares) publicly stated that they could not meet the commitments under the guaranteed loans of the Act. Pending sale or liquidation they needed time to pay. Ansett then took over, putting £1,000,000 down and guaranteeing to pay the other £2,300,000 over two years. The Commonwealth agreed to extend the period of repayment of the balance outstanding on the loans. The Civil Aviation Agreement of 1957 extended the two-operator principle to all routes, trunk or otherwise, on which the two airlines wished to compete. Within the next few months, Ansett bought out Butler Air Transport (New South Wales), Queensland Airlines (Queensland), and in 1959 Guinea Airways (South Australia). These deals extended his routes and services to a network comparable with that of TAA. Ansett-ANA is today more equal with TAA than ANA ever was.

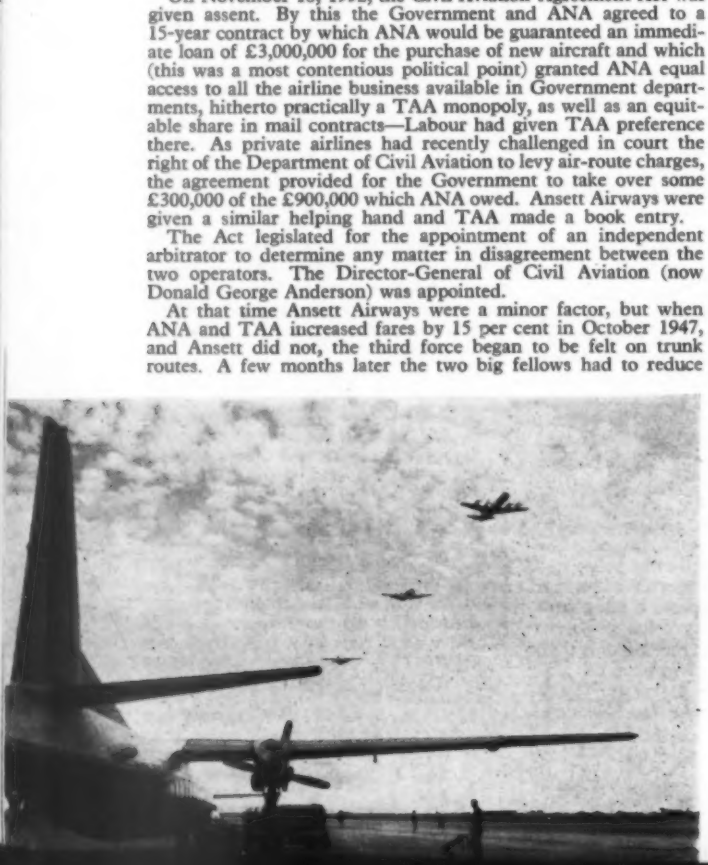
R. M. Ansett, managing director of Ansett-ANA

R. M. Ansett's first difficulty was his combined fleet. He faced the obvious fact that TAA's Viscounts would attract more custom than his Convair 340/440 and DC-6/DC-6B fleet. Moreover, TAA was then not concealing its desire to order two Caravelles. There is no question that if TAA had secured the Caravelles, Ansett-ANA would have found it very difficult to remain in business at all.

The Intention of Clause 3 of the 1952 Act was to enable ANA or their successors to borrow funds sufficient to secure and maintain fleet parity with TAA. Without parity equal competition, route rationalization and other objects of the legislation were impracticable. Ansett decided to order Viscount 800s and Electras. The Government then forebade TAA to order Caravelles—indeed, they prohibited the introduction of any jets on internal routes—and told TAA to order Electras. As their economic survey of the Electra had been adverse TAA were distinctly upset; but being a Government-owned corporation they had no option. Both airlines then had to develop the present fleets of Electras, Viscounts and Friendships. The Friendship had been ordered by TAA, but to reach the goal of rationalization Ansett had to be given a similar priority.

The Airlines Equipment Act, 1958, amended the Australian National Airlines Act to enable the Commission to borrow up to $6,600,000 (Treasury advances or Government loans) for buying Electras and Friendships. TAA was also empowered to borrow up to $3,000,000 in actual US currency, which was raised from J. P. Morgan and Associates at 4¼ per cent over five years. Ansett Transport Industries Ltd were guaranteed loans of $6,600,000 to buy Electras and spares and up to $4,400,000 to buy Friendships. The loan to Ansett was and is contingent on Ansett being good boys and obeying the Act and the Co-ordinator's decisions on equalization of capacity on the individual routes. The Act provides that neither airline may provide more than 50 per cent of the capacity on any route defined as competitive. There is an obligation on both operators not to introduce aircraft of a type which would upset the balance on any route or which, in regard to the types already in operation, "would be detrimental to the stability of the air transport industry."

This Act and the policy underlying it are unique in the history of commercial aviation. There is no other country with similar



TAA equipment at a Melbourne celebration. On the ground, Friendship; in the air, Electra, Viscount 816 and another Friendship

Ansett's fleet now includes nine Viscounts, four of them 832s; one of the latter is seen here

Australia's Airline Policy an Economic Success . . .

legislation of policy. Australia's attitude can best be understood when it is realized that since the creation of civil aviation control in 1920 the Commonwealth has owned every airport and every airport facility, a very large capital investment. (The Commonwealth is at last divesting itself of a number of airports to local authorities, but the principle stands.) The Government's capital investment in civil aviation permanent way and facilities has been not less than some £A50,000,000, and the recent investment in the way of loans for new equipment had raised that stake.

The latest development in this rationalization issue was the exchange under charter of three Viscount 700s from the TAA fleet to Ansett-ANA (at £160 18s a day) and two DC-6Bs from Ansett-ANA to TAA (at £199 a day). This gives front-line fleet strengths as three Electras and two DC-6Bs for each operator, 12 Viscounts for TAA, and nine Viscounts for Ansett-ANA. The Friendship fleets are not used on main trunk routes.

The Government was very fortunate in that 1959 was the greatest boom year in the Australian airline industry since the 1940s. Comparing individual months of 1958 with those of 1959 there was an increase in passenger traffic of up to 30 per cent —August 23.3 per cent, September 26.4 per cent, October 20.9 per cent. Overall, 1959 was on the average 20 per cent up on 1958. March 1960 was 25 per cent above March 1959. In 1959 the total of passengers carried on Australian internal services passed the 2,500,000 mark. Part of this increase was due to introduction of mass tourist accommodation by the large operators, but a good deal was due to the old airline-industry law that if you put bigger and better aircraft on the same routes more customers will somehow arrive to buy seats in them.

The effect of the Electra's introduction was marked. As Ansett-ANA had been first to order, they got them first. Their first Electra was operating in March, was backed by a nation-wide advertising campaign, broke the 60 minutes for the Melbourne - Sydney flight several times in the first month, and in the first few weeks showed immediate average load-factors of more than 80 per cent first-class, and 90 per cent tourist. As business backed up at airports, it overflowed into the company's DC-6Bs and the two Viscounts it had taken over from Butler Air Transport. The Electra carried 60 first-class and 18 tourist.

In that month of March 1959, TAA for the first time in years lost its lead and the larger proportion of traffic went to Ansett-ANA —57 per cent on the Sydney - Melbourne route. This was due partly to greater capacity: TAA's 44-seat Viscounts, with a load-factor of 78.3 per cent, could not lift the same number of passengers. April showed TAA getting 46 per cent of all the airline passenger traffic in Australia, but when TAA's Electras arrived the month of November showed a tremendous swing—TAA had 55.7 per cent that month. Today TAA is holding its cut of the entire Australian passenger traffic at about 51 per cent. When one allows for the smaller operators, Ansett-ANA are getting some 48 per cent. This is due partly to the greater Viscount fleet operated by TAA and to the difficulty faced by Ansett-ANA in filling the DC-6B in the face of turboprop competition. The March exchange of Viscounts and DC-6Bs will tend to level this out, but nevertheless neither operator will be able to secure proper utilization of the DC-6Bs until both are (as expected) given rights to operate into New Guinea. (Qantas will leave New Guinea shortly, if the Government changes its New Guinea policy as forecast in political circles.)

The fleets are now at a parity which will continue for some three years, unless the present expansion of business continues. Though the Australian economy is extremely buoyant, neither operator believes the extraneous factors which caused the 1959 boom will continue into late 1960. They expect the growth factor to be about 10 per cent each year for the next few years, if the economy expansion is stable.

Mr Ansett told me that his fleet has sufficient slack to soak up this expansion over the 1960-63 period by increased utilization, though perhaps one more Viscount might be needed. John Ryland, general manager of TAA, has similar views.

These two gentlemen are, however, at variance concerning other forecasts. Mr Ansett told me he believes it will be necessary for his airline to secure an average load-factor of 70 per cent over all services, to soak up the losses on uneconomic services. Now, it has been stated by such authorities as Dr H. W. Poulton, Assistant Director-General (Policy) of the Department of Civil Aviation, that 70 per cent is the optimum load-factor under Australian conditions on the major trunk routes. The TAA reaction to this was that Mr Ansett was flying a kite.

My own feeling, after talking to both executives and to the Department, is that while both operators are still very sore-headed over the complete Government ban on individual ambitions and plans for development they are finding the rationalization policy is working out in economic practice. The policy does force a high load-factor—some people believe this will be too high and that before long passengers will be waiting at airports for vacant seats.

Ansett Transport Industries, of which Ansett-ANA is a subsidiary, pay 10 per cent to their shareholders. Mr Ansett rightly points out that TAA can secure their capital much more cheaply; moreover they can use their £3,000,000 employees' superannuation fund, which a non-Government enterprise is forbidden to do. Though Mr Ansett in public statements deplores the continued Government control of TAA, he admits that the two-operator system is ideal for the country. So does Mr Ryland.

From the public's standpoint, the rationalization policy has not quite given the competition which was expected. The airlines now get together and agree on too much—an example is the staggering fall in quality of the food served on Australian airlines over the past year. The breakfast on either airline on the Perth - Melbourne run is now disgraceful. The former Australian boast that we have first-class services for what are by European standards tourist-class fares cannot now be sustained. The travelling public is quickly grasping the point that it is no longer enjoying the benefits of cut-throat competition. A recent example was the decision by both operators not to introduce economy fares—lower than tourist—because it was believed many passengers would stop paying tourist fares to go economy-class. Little competition there!

John Ryland, general manager of TAA

The most powerful figure in Australian aviation today is a civil servant, Donald G. Anderson, Director-General of Civil Aviation and the co-ordinator under the Act. He holds in his hands the balance of power. This is so finely tuned that a consistent drop of 1 per cent in business by either competitor would soon put it out of business. The presence of the co-ordinator means that in practice very few decisions are made by him, because his decision would generally be a compromise; the airlines might as well—and do—reach compromise decisions without him.

The effect of the rationalization is felt in other ways. It can now be taken for granted that Australian internal airlines will not be permitted to introduce jet equipment for the next five years. The Government explanation is that the airport system cannot handle jets, but this is in spite of the fact that only 30 months ago TAA had tacit permission from the Department to consider planning for nearly 30 jet (Caravelle) movements a week in and out of Essendon Airport (Melbourne) alone. General opinion here is that the Department is now forcing the issue with the Government, employing this "lack of jet airports" to secure Cabinet approval for the construction of a jet airport at Tullamarine near Melbourne and improvement of others.

The overall effect of the Government's policy may be briefly summed up as follows:—

- The operators are now in a period of stable economic operation.
- The Government is protecting its large investment.
- There is no fear that one of the operators will fail.
- The passenger is securing a flat level of service, without the development which true competition will give.
- The quality of service on Australian airlines is gradually deteriorating and the process will continue.

In general, the very reason the apologists use for this policy —that two airlines are needed to maintain standards—is not realized in practice. But this does not mean that the two-operator system is not superior to the monopoly system that would have appeared willy-nilly had Ansett not bought out ANA.

A recent photograph of the Beech Model 33 Debonair (225 h.p. Continental), showing the aircraft's attractive new paint scheme

Sport and Business

AIR RACING DETAILS for this season have been announced by the Royal Aero Club. First event is the London - Cardiff race on June 3, which will be flown between White Waltham and Rhoose. For the purpose of qualification for subsequent races the London - Cardiff entry will be divided into three classes, and the winner will receive the Grahame-White Memorial Trophy. The race is open to British and foreign aircraft, entered by a British sponsor and flown by a British pilot, up to a maximum gross weight of 12,500lb.

The first fourteen aircraft to finish in each class in the London - Cardiff race will form the entry for the three handicap class races to be held on June 4 at Rhoose. These will be for the Air League Cup, Norton-Griffiths Trophy and D.H. Tiger Moth Trophy, and will be flown respectively over four, three, and three laps of an 11-miles course.

The first seven British aircraft placed on points in each class after the London - Cardiff and class races will go forward to the King's Cup race at Baginton on July 9. This will be flown over four laps of an 18-mile circuit, and the SBAC Cup will be awarded to the pilot making the best speed over the course. Eliminating and final rounds of the British Lockheed Trophy aerobatic contest will also be held at Baginton on July 8 and 9.

MANCHESTER FLYING CLUB, formed in February to replace the disbanded Ringway Aero Club, hopes to operate a Luton Major and an Auster at Manchester Airport. Officers of the club include Harry Knight, CFI; Ken Clayton, chairman; and Jack Cowap, secretary (from whom further information is obtainable at 1 Manor Road, Abbey Hills, Oldham, Lancs).

THE SPORT OF GLIDING is an inexplicable mixture of serenity and excitement, loneliness and teamwork, frustration and satisfaction. It is also a graceful art which can do well before the camera, as a recently published collection of photographs* attempts to show. Unfortunately the book fails to do justice to its subject.

The main fault lies not in the choice of photographs, although a better selection could have been made, but in the gravure process chosen for their reproduction. This reduces the photographs, many of which are of high original quality, to a fuzzy, coarse-grain uniformity in which the sparkle and clarity of the air-to-air portraits, in particular, are lost.

In their subject-matter the 96 photographs portray most aspects of gliding—the tangled coil of a broken launch-wire as well as the glories of cloudscapes and mountains. The best air-to-air shot in the book is that of a Slingsby Swallow taken by Harry Hensser (who is here responsible for no fewer than 23 pictures). Among the other photographers represented are Charles Brown, Philip Wills, and Ian Macdonald and L. W. McLaren of *Flight*.

The excellent introduction by Philip Wills is based on three previously published classic accounts of his own gliding adventures, including *In the Mountains of the Sky* from *The Sunday Times;* and *Riding the Mistral* from *Flight*. It is well worth re-reading the latter, if only to recall the fantastic exercise of slope-soaring in the French Alps—in cloud—and the revealing phrase which summed up the justification for it: "However, this was World Championship flying, not a Sunday afternoon at Dunstable, so . . ."

K. T. O.

*"*The Beauty of Gliding,*" a collection of photographs, with an introduction by Philip Wills. Max Parrish & Co Ltd, 55 Queen Anne Street, London W1. Price 35s.*

THE PIPER DISTRIBUTORS in this country, Vigors Aviation Ltd of Kidlington, have announced that the Tri-Pacer and Caribbean have now been approved by the Air Registration Board in the Public Transport Category (Hire and Reward).

A BEECH MODEL 65 QUEEN AIR was flown to a height of approximately 35,400ft by James D. Webber of Beech Aircraft Corp recently in an attempt to set up new altitude records (national and international) for light aircraft in the C-1d class. The previous world record was 30,361ft by Miss Jerrie Cobb in an Aero Commander 680S in July 1957.

AEROBATIC CHAMPION at the Baginton contests of 1955, 1956 and 1958, Léon Biancotto is to fly a Nord 3202 trainer during this season's events. The aircraft, which is powered by a 240 h.p. Potez 4D.32 engine, is on loan to the Nord company from ALAT (Aviation Légère de l'Armée de Terre).

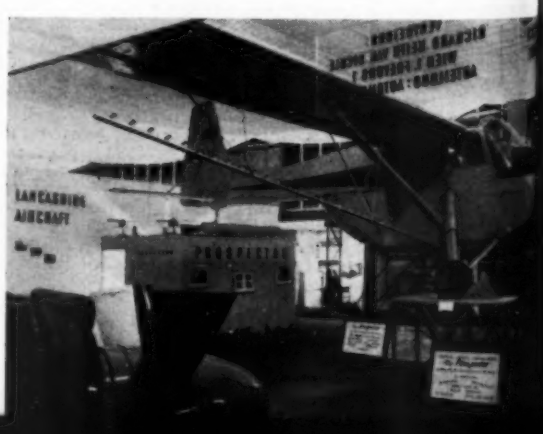
A LIST OF GLIDER PILOTS holding Gold C badges with three diamonds, published recently by the Fédération Aéronautique Internationale, shows Poland to be in the lead with 49, followed by France with 45, the USA (15) and Germany (10). On the list Britain is credited with only one pilot, Nicholas Goodhart, although Cdr Goodhart's brother Tony has recently also completed the requirements for his third diamond.

ELLIOTTS OF NEWBURY have quoted £1,000 as the price of the company's new 15-metre single-seat glider, the prototype of which is expected to fly this month. Two or three machines will be flying this summer, and the type will be generally available next year. Intended as a successor to the Olympia 2b, the new machine has been designed according to the main considerations of weight, economic construction, performance and handling, and ease of repair. Hire-purchase terms, involving a 25 per cent deposit and repayment over three years at 4½ per cent interest, are now available for Elliotts sailplanes.

RETROSPECT

From "Flight" of April 16, 1910

Foreign Spies at Chalons: As a consequence of the rumours which reached the ears of the French Minister of War that under the guise of learning to fly, various foreigners have been straying over the military quarters and taking notes, new regulations, as we foreshadowed, have been promulgated for the use of the parade-ground by aviators. Henceforth, each aviator, and every one of his pupils, must obtain a permit, on which will be mounted a photograph of the holder, from the military authorities, before he will be allowed to fly, and even then he must be careful not to fly over certain parts of the camp. Moreover, flying between the hours of 8 a.m. and 7.30 p.m. is strictly forbidden.



At the Vienna International Trade Fair, one example of the Lancashire Aircraft Prospector (295 h.p. Lycoming) was exhibited (right) while another gave flight demonstrations at Vienna Airport. Current price of the Prospector is £9,810

AIR COMMERCE

Britain Goes It Alone

BY J. M. RAMSDEN

HAVING put a cabotage pistol to IATA's head, and forced the Association under duress to agree to reduced fares, Britain has in effect said: "Thank you, well done," and then proceeded to pull the trigger.

It would not be surprising if, as a result, a certain amount of goodwill were to be lost—goodwill which was in short supply after the Honolulu fares conference last autumn, when BOAC, publicly backed by H.M. Government, first rocked the IATA boat with the cabotage threat.

But IATA knows full well that Britain has always had the right to charge whatever fares it wishes on its sovereign routes. As BOAC's chairman, Sir Gerard d'Erlanger, said just before Honolulu, "we have always played the game with IATA, so as not to undermine the international fare structure." Since 1952 the independents have operated some colonial coach services to British territories in Africa and the Mediterranean. Their terms of reference—inferiority of equipment and service, etc—were such as to minimize diversion even from the British corporations. So IATA never complained, even though the corporations sometimes did.

Though at first sight it may seem that Britain has double-crossed IATA, things should be kept in proportion. IATA may well fear diversion of traffic by this apparent cabotage sabotage of sacred fare agreements. But the proposed services will be of limited frequency, and restricted to British nationals only.

So, though Britain has pulled the trigger, the shot should do little injury to IATA. And, after all, what Britain is doing is strictly her own affair. Protests will no doubt be met with the unassailable retort that we are jolly decent chaps anyway for only now exercising sovereign rights that we have always had the right to enjoy.

The Minister's policy (influenced no doubt by his hard-working civil servants, who were grappling with these problems for a long time before he came to power) was that charity, to coin a phrase, begins at home. He had to reconcile the vigorous expansionist demands of private enterprise air transport with the equally vigorous demands—echoed by all reasonable people, including the independents—that the corporations should not be undermined. The decision-forcing catalyst was the now famous series of VLF applications put in by Harold Bamberg of Eagle in November 1958—a year before Mr Sandys came to power.

It is VLF more than any other single event which has brought about the new deal. It must be agreed that the resultant compromise is one which appears to satisfy most of the parties concerned, except those loyal employees who have fallen victim to mergeritis, and the public, for whom fares are never low enough.

The table on this page compares the new fares with the old: the new colonial coach fares, which are to be introduced on October 1 (col D), appear in bold type. It will be seen from the table that a good deal of important information is not available. As *Flight* went to press, nothing was known about the pool agreements made between the corporations and the independents. Pressed in the Commons for this information, publication of which Mr Strauss (Lab, Vauxhall) considered to be in the public interest, Mr Sandys said he did not want to interfere with "any wish that might be arrived at between the corporations and the companies concerned." The Minister is likely to be pressed further on this point. Cartel agreements between British companies which fix output and pool earnings are *prima facie* not in the public interest, and they should certainly be subject to public accountability, particularly when nationalized corporations are involved.

Two questions arise from the table other than those concerning capacity-sharing: Why are there no new colonial coach fares to Gibraltar and Malta? And why is the new Hong Kong IATA fare (economy) £9 more than that quoted by the Minister in the Commons?

British United Airways—now officially the name of the Airwork/HCA consortium—will share with BOAC, EAA and CAA the new cabotage-fare services to British East and Central Africa, though it is not known in what ratio revenues will be shared out. British United will also share with these corporations the economy-fare services, but again it is not known on what basis the share-out has been agreed. This new independent will not participate in the first-class services, as will Eagle on the Bermuda route.

Curiously, the BOAC statement which followed the Minister's address to the Commons made no mention of the corporation's partnership with Eagle and Cunard on the Bermuda route. The Minister confirmed that Eagle, in which Cunard are to acquire a majority holding, will operate services of *all* classes between Britain and Bermuda. It is understood that each airline will operate alternately the colonial coach service to Bermuda, but no details of frequency, or of the BOAC-Eagle revenue-sharing pool as a whole, are available.

BEA are involved in the new deal only on the Malta and Gibraltar routes. Skyways' Constellation 749As (65-seaters) will operate in pool to Malta with BEA's Viscounts from April 19, but not at a special cabotage fare (see table). This will evidently compensate Skyways for the Cyprus Crusader colonial coach Hermes service, absorbed last month by BEA's night tourist Viscount service. On the Gibraltar route HCA are to pool with BEA, using Viscounts instead of the present colonial coach Vikings, but again (see table) not at a special cabotage fare.

The future of Silver City remains a matter for speculation. British United Airways' "sphere of influence" is Africa, and Eagle-Cunard's sphere is the Atlantic. No independent is likely to have the Far East as its sphere, because of the delicate BOAC arrangements with Air-India and Qantas. One guess is that BEA and British Railways may shortly come to an arrangement which will involve Silver City. There has also been some evidence recently that Silver City are likely to become Handley Page Herald operators.

Footnote: Cabin service on the new colonial coach services will include free non-alcoholic drinks, and "light packaged meals" will be on sale. Free baggage allowance is 33lb. No information on seat pitch is yet available, nor on the types of aircraft that will be used. Special inclusive-tour rates will be introduced to certain (as yet unspecified) British cabotage points: in addition special student fares will be available 44 per cent below the lowest IATA level, compared with the present 25 per cent rebate.

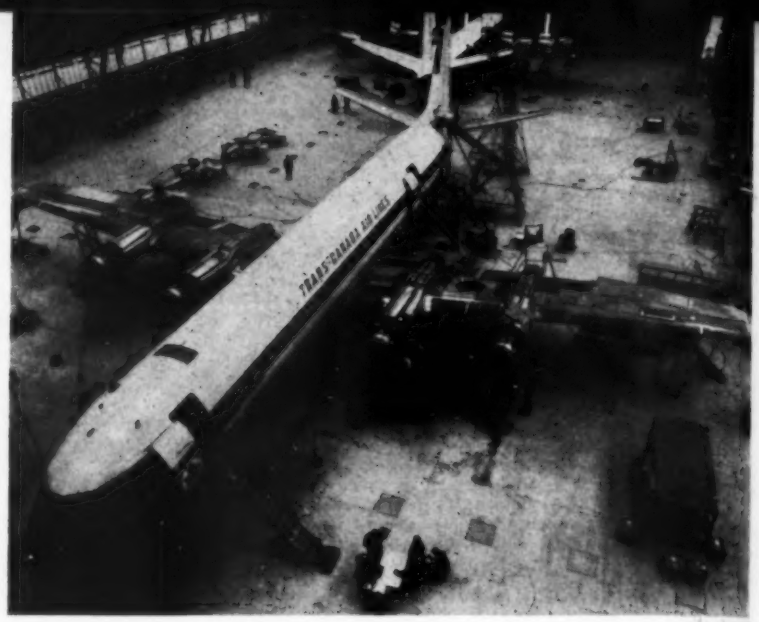
NEW FARES FOR OLD—AND SOME QUERIES

London to:	A Old IATA lowest tst. ret. fare	B Old Colonial coach cabotage ret. fare (% redn. on A)	C New IATA lowest ret. ecy. fare (% redn. on A)	D New Colonial coach cabotage ret. fare (% redn. on A and C)*	E Oprs. of C and % share ( ) of capacity	F Oprs. of D and % share ( ) of capacity	G Frcy. of D	H Old VLF ret. fare (% redn on A)
Aden	£217 16s	—	£183 12s (16%)	£153 (30%) (17%)	BOAC and ?	BOAC and ?	?	£107 (51%)
Bahamas ...	£231 10s	—	£189 15s (18%)	£162 (30%) (15%)	BOAC and ?[1]	BOAC and ?[1]	?	£140 (40%)
Barbados ...	£268 3s	—	£232 15s (13%)	£187 4s (30%) (20%)	BOAC and ?[1]	BOAC and ?[1]	?	£160 (40%)
Bermuda ...	£218 13s	—	£180 (17%)	£153 (30%) (15%)	BOAC and Eagle (?)	BOAC and Eagle (?)	?	£124 (43%)
Gibraltar ...	£38 15s	£30 10s (21%)	£30 10s (21%)	—	BEA and HCA (?)	—	—	£21 4s (45%)
Hong Kong ...	£415 16s	—	£374 8s (10%)	£311 8s (25%) (17%)	BOAC[2] (100)	BOAC[2] and ?	?	£246 (40%)
Jamaica (Kingston) ...	£252 15s	—	£212 5s (16%)	£176 8s (30%) (17%)	BOAC and ?[1]	BOAC and ?[1]	?	£150 (40%)
Malta	£42	—	£33 13s (20%)	—	BEA and Skyways (?)	—	—	£19 (55%)
Nairobi ...	£234	£199 16s[4] (15%)	£196 4s (16%)	£165 12s (30%) (15%)	BOAC[2] and Br. United[5] (?)	BOAC[2] and Br. United[5] (?)	?	£100 (57%)
Nicosia† ...	£85	£80[6] (6%)	£85 (=)	—†	BEA and Skyways (?)	—	? —	£100 (57%) £41 15s (51%)
Salisbury ...	£264 12s	£228 12s[7] (14%)	£221 8s (16%)	£185 8s (30%) (16%)	BOAC[2] and Br. United (?)	BOAC[2] and Br. United[5] (?)	?	£145 (45%)
Singapore ...	£363 12s	—	£327 12s (10%)	£273 12s (25%) (11%)	BOAC[2]	BOAC[2] and ?	?	£199 (45%)
Trinidad ...	£283 10s	—	£242 8s (15%)	£198 (30%) (18%)	BOAC and ?[1]	BOAC and ?[1]	?	£165 (42%)

*From October 1. †Soon to be non-cabotage. (1) Eagle? (2) BOAC and pool partners. (3) Eagle's VLF fare—HCA/Airwork £30. (4) HCA/Airwork "Safari," EAA "Canadair Coach." (5) British United Airways—Airwork and HCA. (6) Skyways "Crusader." (7) HCA/Airwork "Safari," CAA "Zambezi."

Abbreviations: Tst., tourist; redn., reduction; ecy., economy; ret., return; oprs., operators; frcy., frequency.

AIR COMMERCE . . .



Here is CF-TKA, the first of 20 Vickers Vanguards for TCA nearing completion in the new pre-flight hangar erected for VC10 production at Weybridge. Delivery is due in August, and the first flight later this month

COMET TO WARSAW

HAVING earlier put difficulties in the way of BEA's Comet operations to Warsaw (*Flight*, January 15) the Poles have now agreed to the replacement of Viscounts by Comet 4Bs. LOT plan to use Il-18s. The first Comet service, which will be a twice-weekly operation, took place on April 2.

The agreement follows discussions in Warsaw between the civil aviation authorities of the two countries, when the signing of a permanent agreement between the UK and the Poles was recommended. Under the proposed agreement BEA and LOT will have rights to extend their existing services between London and Warsaw to other points in Europe.

CERTIFICATE FOR BOAC's 707s

AS this issue went to press ARB-certification of the Boeing 707-420 for BOAC and delivery of the corporation's first aircraft, were imminent. It will be recalled that the ARB, which was originally expected to certify the aircraft in time for delivery to BOAC before the end of December, called for modifications to the rudder boost system, increased fin area, and the fitting of a ventral fin.

The ARB chief test pilot, D. P. Davies, was expected to conclude his acceptance tests of the aircraft at Seattle this week, and deliveries to BOAC should follow immediately. The corporation now plans to inaugurate transatlantic services on June 6, incidentally scheduling a faster London - New York time than PanAm, TWA and Qantas, who have agreed to schedule 7hr 40min to avoid an advertising speed race. BOAC's time, justified by the greater power/weight ratio of the 420, is 7hr 20min.

Meanwhile, BOAC crews (24 pilots and 21 flight engineers) have been carrying out conversion-training with an advance-delivery 707-420 from Tucson, Arizona, since April 4. It is planned to continue these flights from the naval air station at St Mawgan, Cornwall.

RAILS ON TO THE BRIDGE

IN a paragraph on these pages on April 1 it was suggested that the breakdown in negotiations between Silver City and British Railways did not rule out closer commercial co-operation between rail and air. The possibility was aired again in our recent study of domestic air services (issue of April 8).

That there was a sound basis for these suggestions is made clear in a recent announcement by Air Charter that combined arrangements are being made between the Channel Air Bridge and British Railways Eastern Region for rail/air, no-passport day trips to Calais. While it is not true to say that there is an inter-availability of tickets—there is no overlap between the rail and air spheres of the operation—it is now possible to buy at a number of railway stations one ticket for the rail/air journey. The railway lines concerned are British Railways' Great Eastern and London, Tilbury and Southend lines, and booking for no-passport day trips to Calais is possible at Liverpool Street, Stratford, Ilford, Romford, Shenfield, Fenchurch Street, Barking, Upminster and Grays stations. Similar day-trips may also be made to Ostend and Rotterdam, but at present the no-passports facility does not apply.

The Home Office recently announced that no-passport trips can now last up to 48hr and extension of these excursions is being considered. Fares to Calais range upwards from £4 6s 6d and the season lasts from April 10 to October 31. Last year the Channel Air Bridge carried more than 20,000 people on no-passport trips to the Continent.

This is the crew of the Tu-114 which on March 24 flew a 1,000km course Moscow - Orsha - Moscow in 1hr 9min—at an astonishing average speed of about 544 m.p.h., and with a payload of 25 tons. Eight FAI records for the 1,000km closed-circuit are claimed. Altitude was 8,000m (26,250ft). The commander, I. Sukhomlin, is second from left in the front row. The Tu-114 is expected to enter service soon

MAURICE CURTIS RESIGNS

THE managing director of Hunting-Clan Air Transport, Maurice Curtis, has resigned. At the same time Capt L. B. Greensted has given up his post as HCA's operations director and has left the company.

These moves confirm that Airwork will be the dominant company in British United Airways, the name (*Flight*, March 11) which is now certain to be given to the Airwork-HCA consortium. The managing director of Airwork, M. D. N. Wyatt, is likely also to be managing director of British United, as it will be called. No other management changes have been announced as yet.

Mr Curtis—who is 47 years of age—told us last week that, at the moment, he has "absolutely no plans for the future." About recent suggestions that he might be a candidate for the new Licensing Board he was likewise non-committal. One of the original batch of Imperial Airways trainees in 1930, Mr Curtis held various executive posts with BOAC, including that of manager Far East and manager North Africa. In 1946 he transferred to BEA as traffic controller, but left (he was then traffic manager) in 1948 to join Skyways; in 1950 he took up an appointment as general manager of Hunting Air Travel, as HCA then was. His resignation as managing director of HCA took effect on March 31.

THE LEAGUE HAS A PLAN

JUST published by the Air League of the British Empire is an attractively produced 21-page booklet "The Future of British Air Transport." In it the League advocates a VTOL Mach 3 supersonic airliner; a VTOL short-to-medium range "air bus"; a development of the Vanguard and a stretched D.H.121; vigorous encouragement of the Fairey Rotodyne and helicopters; and development of automatic air traffic control, with special emphasis on VTOL operation. We hope to review the League's ideas at greater length in a subsequent issue.

FALCON APPLY FOR CYPRUS

LAST week Falcon Airways of Bournemouth, the company formed by Capt M. Kozubski after he left Independent Air Travel, applied to the Cyprus authorities for permission to fly British Servicemen and their families on leave to Britain for £45 return. This compares with the special Forces' £60 return fare charged by BEA and Cyprus Airways. Normal night tourist fare is £85 return.

Falcon said in their application that they would use Hermes, of which they own two, and said that they could begin the service on May 5 subject to the approval of the authorities. They propose weekly flights, and the fare includes a baggage allowance of 20kg. Will the applicant be told, following previous experience of applications to colonial authorities, that the matter is primarily one for HM Government? Since Cyprus is soon to be independent, this point is not clear. However, the Minister would seek the advice of the Air Transport Advisory Council since a scheduled commercial air service is proposed, and not a trooping contract with the Service departments. Because the ATAC is soon to give way to the Air Transport Licensing Board, it appears that Falcon will be fortunate to receive approval for the operation of this service—which the established carriers will no doubt consider to be diversionary—by May 5. No one in Falcon was last week available to comment on the application.

MORE FREEDOM FOR CARGO

FREEDOM of the air is one of those ideals which, in an imperfect air transport world obsessed with national sovereignty, never seems attainable. Yet, in a quiet way, an important first step towards this ideal has been taken.

As from April 11, twelve European countries waived traffic rights in respect of non-scheduled air services. The countries are, in addition to the United Kingdom: Austria, Denmark, Finland, France, Federal Germany, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and Turkey.

The agreement (known as the Multilateral Agreement on Commercial Rights on Non-Scheduled Air Services in Europe) means that UK operators may now, without permission, operate to these countries flights which (1) have the entire capacity chartered by a single organization; (2) are single flights operated at a frequency no greater than monthly; (3) are all-cargo flights; and (4) which "transport passengers between regions which have no reasonably direct connection by scheduled air services." So far as items (3) and (4) are concerned, individual countries reserve the right to determine how the wording of the agreement shall be interpreted should they feel that the spirit of the agreement is being abused.

In addition, "occasional" taxi flights (with aircraft seating no more than six passengers) and emergency flights require no prior permission.

Thus, so far as freight is concerned, there is now complete freedom of the air in all west European countries except Belgium and Italy. It has taken about 10 years of painstaking discussion, primarily under the *aegis* of the European Civil Aviation Conference (the European branch of ICAO) to reach this agreement, which supersedes a number of bilaterals between the UK and other European countries allowing more liberality towards non-scheduled services. It is a small but significant step forward.

The full text of the agreement (Paper No 879) is available from HM Stationery Office, price 6d. Enquiries about the clearance action necessary for non-scheduled flights to the countries concerned should be addressed to the Ministry of Aviation (ACG4), Berkeley Square House, London, W.1 (Mayfair 9494, extension 2849 or 3137).

THE SHADOW OF MUNICH

DID Capt Thain, commander of the BEA Elizabethan which crashed on take-off from Munich on February 6, 1958, take sufficient steps to ensure that the wings were free from ice and snow? Did he ascertain whether the runway was fit for use in the prevailing conditions? What was the cause of the difficulties—said to be due to fluctuations of boost pressure—on the two previous abandoned take-offs?

Capt James Thain, whose representations about the Munich accidents were heard in London last week. He is seen here with his wife, who was to give technical evidence on physical and chemical matters. A note on the hearings begins in column one below

These are the questions which last week were put to the independent body of three—E. S. Fay, QC (chairman), Professor A. R. Collar and Capt R. P. Wigley—set up by the Ministry of Transport and Civil Aviation to review Capt Thain's representations that the cause of the accident was not ice on the wings but slush on the runway. Attempts to persuade the German authorities to re-open the inquiry have now been officially turned down as having no justification and the tribunal, in its capacity as a reviewing body into an accident investigated by a foreign authority, was said by Capt Thain's counsel to be unique.

The argument put forward by James Comyn for Capt Thain on the opening day of the inquiry was that the layer of ice found on the Elizabethan's wing had been discovered six hours after the accident. The Germans had not made a finding on evidence but had advanced a theory and argued it out rather than supporting it with evidence. Capt Thain had satisfied himself that the wings were free from snow.

CAPITAL ASKS FOR A SUBSIDY

CAPITAL Airlines has recently asked for a US Government subsidy of 22.6 cents per revenue aircraft-mile to help the airline over a difficult period. Misfortunes are blamed on "unprecedented severity of the winter weather, the series of recent air accidents and the continuing effects the publicity of these factors has had on the public."

The petition to the CAB said that the airline's load factor fell sharply after the accident at Holdcroft (*Flight*, January 29, page 160) on January 18. The aircraft—one of Capital's 60-strong fleet of Viscount 700s—crashed in fog in a ravine and there were no survivors among the 50 people on board. Capital has told the CAB that it lost all of $6m from 1956 to 1959 and that it is losing money at an accelerated rate this year; the combined loss for January and February was nearly $4m, while further heavy deficits were expected in March.

If Capital are granted a subsidy they will be the first major US carrier to receive one since 1955.

THE RIGHT MAN FOR THE JOB

BRITISH salesmen are sometimes criticized for being out of touch with their markets, or for maintaining insular opinions, or even for being "too British." Perhaps these were some of the thoughts that inspired a pleasant little story in the *Daily Mail* about the Avro sales manager's attempts to interest the Russians in the Avro 748.

The man concerned is Emanuel Galitzine, and the newspaper introduced him in this way: "Prince Emanuel Galitzine is the youngest son of Prince Vladimir Galitzine, a former officer of the Russian Imperial Guard, and a direct descendant of Catherine the Great. He was a Battle of Britain pilot, won a DFC, and is now sales manager of A. V. Roe & Co. He is also a direct descendant of George II of England."

How would a White Russian prince go down in Soviet Russia? "I kept on being astonished," says Prince Galitzine, "at the way the mere mention of my name and title opened doors for me which would normally have remained closed and got me whatever I wanted. The Soviet air authorities granted me an interview with no delay at all when I informed them I was interested in telling them about the Avro 748. . . ."

Eleven months after the inauguration of BEA services to Moscow, Comet 4Bs took over from Viscount 806s. Here is the inaugural jet service a few moments after arriving in front of the Vnukovo terminal building. In an interview Lord Douglas said: "We have been working together for a year now and we have had no trouble at all"

AIR COMMERCE . . .

SELL AND REMEMBER

A PREREQUISITE of the sale of a commercial aircraft to a new customer is for the manufacturer to explain exactly what he intends to provide in the way of after-sales service. Then the object must be to provide that service and nothing less.

At a recent meeting at Baginton, attended by Capt R. G. Gibson and M. Ebbett, respectively general manager and chief engineer of Trans Arabia Airways, and by the representatives of 18 major sub-contractors to the Argosy, Armstrong Whitworth undertook to establish a parts stores at Beirut, with the object of providing over-the-counter service to Trans Arabia for all AWA-manufactured parts required to keep the Argosies flying. In addition "almost all" the sub-contractors represented at the meeting have agreed to provide a 24hr AOG service, either by locating stocks in Beirut, or by guaranteed delivery from London within 24hr.

Thus it seems that AWA are determined to learn from the past experience—and from the mistakes—of manufacturers older in the business of selling commercial aircraft abroad than themselves. Ample evidence of this determination is provided in the recently published second edition of their After Sales Service brochure for the Argosy.

This booklet covers in some detail the many services to be provided to the customer after sale, field service, airport handling in the overhaul and loading bays, customer training, technical publications, X-ray inspection, warranties and service instructions.

For parts service a relatively simple system of provisioning cards, coloured pink, yellow or green, to indicate the degree of anticipated usage, has been introduced for the small operator. These cards, used in conjunction with a fully illustrated catalogue of replaceable parts and a set of microfilmed drawings, are supported by a carefully controlled modification record system. This should give the operator a comprehensive picture of the Argosy parts breakdown for provisioning and re-ordering purposes. A more advanced parts provisioning and ordering system, developed to ATA 200, is intended for larger operators possessing data processing equipment.

AWA further intend to maintain an "off-the-shelf" parts service, which should enable them to provide the guaranteed delivery so important to the commercial operator. A list at the back of the brochure covers the after-sales services which are available for the ancillary equipment in the Argosy. There are more than one hundred manufacturers on this list, and it is the availability of the washers, springs, seals, brushes, etc, for their products which will ultimately prove the success or failure of AWA's carefully laid plans.

Further encouraging news is that the Air Ministry have adopted AWA's provisioning scheme for the 660, and that Short Brothers & Harland are thinking along the same lines for the Britannic. This could be a pointer to the direction to be taken by the whole industry.

Footnote: "Sell and Remember" is the title of the release accompanying AWA's new brochure. An article on after-sales service in the industry, "Sell and Forget?", appeared in *Flight*, October 16, 1959.

WHEN PRESSURE FAILURE THREATENS

THERE can be no indecision when pressurization failure appears likely; the only safe recourse is in immediate descent to a lower altitude. This was the situation which on April 3 faced an Air France pilot in a Boeing 707 with 55 passengers and seven crew on board when 25min out from Paris on a flight to New York. The aircraft was at 23,000ft when the captain discovered a crack in the laminations of his windshield. He decided immediately to spill the cabin pressure and to descend as quickly as possible to 10,000ft. Drop-down oxygen masks were ejected from their containers and the hostesses and stewards helped the passengers to don them, only to be overcome themselves by lack of oxygen before they could regain their own seats and apply their masks. They were unconscious for about two minutes but revived at the lower altitude. Some of the passengers were said to be slightly affected by the rarefied air and some experienced bleeding from the ears, due to the rapid changes of pressure.

The aircraft returned to Paris but was not able to land immediately because of a faulty fuel dump valve; 10,000gal of fuel had to be burned off before the 707 was down to landing weight.

VANGUARD CALYPSO

UPON the aspirations of the West Indies for its flag carrier BWIA will depend the type of aircraft to be ordered by the Federation. As recorded in a paragraph on these pages on March 4, the airline is shopping for a US jet with which it hopes to capitalize on the forthcoming tourist boom to the Caribbean. But BWIA also have hopes—when independence is achieved, perhaps less than two years hence—of becoming transatlantic operators, and it is with such services in mind that equipment decisions are being taken. First in line is probably the Convair 600.

How do these plans accord with BOAC's whole ownership of the Federation's airline? Or the recent sales tour to the West Indies by the British turboprop Vanguard?

While the corporation retain their interest in BWIA, there seems little likelihood that the agreement of BOAC Associated Companies will be given to the purchase of foreign equipment without which, the Federation argues, these long-term aspirations cannot be brought to fruition, although BOAC might operate transatlantic services for them. So the choice confronting BWIA and the Federation may be either to develop existing services in association with BOAC while moving towards an autonomous West Indian airline, or to swing away from BOAC altogether and branch out—either on their own or in association with another operator—into intercontinental services. Another suggestion is for a compromise partnership, with majority shares to be taken by BOAC and possibly by TCA, with the remainder of the capital being found by the Federation.

If long-haul jet services are BWIA's aim, the present network of regional Caribbean services might suffer from the new operation and from the employment on these island routes of jets purchased primarily for longer hauls. The Vanguard fits into this picture as perhaps the most suitable aeroplane for the inter-Caribbean routes and as a vehicle for offering low fares on services to the USA. For BWIA it would be the natural follow-on type with which to replace their Viscount fleet and no doubt its purchase (or lease) would readily be endorsed by BOAC.

In Trinidad between March 22 and 26 the Vanguard demonstrated its regional capability to the airline's working management (although not to the chairman, H. O. B. Wooding, or the general manager J. H. Rahr, who were attending a BOAC associate's meeting in London), and to government officials, public notabilities, representatives of other airlines, travel agents and others. The most significant day was probably March 25 when 60 people and 10,000lb of freight were flown from Piarco to Barbados and Antigua back to Piarco—1,000 miles of inter-island flying—in three hours' total block time. Take-off from Antigua's 5,000ft runway was made at ISA+17°. After checking out on the Vanguard on March 24, BWIA captains flew it under Vickers supervision throughout the following day.

BREVITIES

Yugoslavia became the 77th member-State of ICAO on April 8.

Aer Lingus' Dublin - Yeadon service was inaugurated on Saturday, April 2.

The first five Convair 540s for Allegheny Airlines will be converted by the Garrett Corporation's AiResearch Aviation Service Division at Los Angeles International Airport.

The Handley Page Dart Herald now being demonstrated in Brazil has curtailed its programme to carry clothing and medical supplies from Recife to the flooded Fortaleza area 800 miles away.

In a written parliamentary reply Duncan Sandys, Minister of Aviation, has said that the average noise pressure-level of the Comet 4B was 90 decibels, a figure which was exceeded by several piston-engined airliners regularly operating at night.

Last Monday the Minister of Aviation was to be asked "whether he is aware of the unsatisfactory nature of the investigation into the accident to G-AMZD, a Transair DC-3, in Spain . . . and whether he will consider publishing a more detailed report."

A paper on "Power Plants for Supersonic Transport" is to be read in the central hall of the Hatfield Technical College by J. S. Alford, AFRAeS, design engineer of the General Electric Company on May 11. The occasion is the second Halford lecture.

In Boeing's 1959 annual report, recently issued, it is said in the section concerning the Transport Division that "the company has sustained a very substantial loss on [Boeing 707] orders received to date."

Formal approval was given on April 1 to BOAC for its polar route to Los Angeles. On the same day Air France was formally granted permission to operate into Los Angeles.

The FAA has proposed that all US turboprops as well as turbojet airliners should be equipped with aluminium or steel-strip flight recorders, said to cost about £1,000 each.

Olympic Airways have ordered a fourth Comet 4B only two weeks after the decision to purchase a third was announced. Comet 4s now on order or delivered total 48. It was reported last week that RAF Transport Command may buy 10 Comet 4Cs.

One of BEA's Pionair DC-3s has been sold to Martins Air Charter, the Schiphol-based Dutch independent. Since January others have been sold to East Anglian Flying Services, Travelair Southern Rhodesia and Cambrian.

American Airlines' earnings last year of 7 per cent on invested capital "were not enough," according to the airline's president, C. R. Smith. For financial stability and to enable the airlines to continue to improve services, he said, a return on invested capital of 10-12 per cent was required.

Frederick Gibberd, architect of London Airport's new £3m long-haul terminal. The "Flight" photograph (right), from the west, shows its location. Other landmarks:— (1) BOAC. (2) London Airport North (which the new building will replace). (3) BEA. (4) Pan American. (5) Runway No 2, 05R/23L. (6) London Airport Central. (7) Queen's Building. (8) Control tower. (9) BEA freight hangar. (10) Runway 1, 10L/28R. (11) Runway 4, 15L/33R. (12) Runway 6, 15R/33L. (13) Runway 7, 05L/23R. (14) Runway 5, 10R/28L (showing proposed extension). (15) Southern ATC and radar. (16) Tunnel. (17) Fuel farm.

"Flight" photograph

NEW FRONT DOOR

London Airport is Britain's front door . . . First impressions are important, and the 'shantytown' on the north side is to be replaced by an entirely new modern air station."—Duncan Sandys, Minister of Aviation.

TWO years and eight months after the Millbourn Report on the development of London Airport, and 14 years after the erection of the "temporary" shantytown so notoriously familiar as London Airport North, the Ministry has approved plans for the long-awaited new long-haul terminal. Construction is started.

The basic recommendation of the Millbourn Report, namely that a new terminal for long-haul traffic should be built on the south-west face of the central area, has been accepted. Some of the detail Millbourn recommendations are not accepted, the most significant being the decision not (for the moment anyway) to connect the terminal with aircraft by means of fingers.

The proposed building, designed by Frederick Gibberd and approved by the Royal Fine Art Commission, is—from a first appraisal of the model—likely to be aesthetically pleasing and comfortable, though the very big question—the means by which passengers should be conveyed to and from aircraft—is left open. Asked last week to comment on the new building, a BOAC spokesman said: "The scheme has been worked out in consultation with us, and although—as is natural in any enterprise of this kind—we are not wholly satisfied, we think that a reasonable compromise has been reached."

The building is designed to allow for the adoption of any of three possible loading methods: (1) Fingers, at least to connect with larger aircraft, and perhaps as extensions of the initial stub piers; (2) gangways or bridges, telescopic or otherwise, from the terminal direct to the aircraft doors; and (3) "mobile lounges," as proposed at Washington Airport (*Flight*, December 18, 1959).

At first, departing passengers will have to go up and then down, all "processing" being on the first floor. But, as the architect says, they have to ascend to (or descend from) aircraft anyway; and it seems that either a mobile lounge or a bridge system would provide the logical answer in the long term.

To begin with, however, passengers will issue from, or enter, two short piers, each terminating in two flights of stairs. The terminal building is flanked by two three-storey office blocks, the upper storeys of which will house airline offices, and the floor levels servicing equipment. The terminal itself is divided through the middle into two completely separate parts, one for arriving and the other for departing passengers.

All baggage will be handled on the ground floor with the aid of conveyor belts. It is not expected that departing passengers will have to go through Customs—though Customs obviously reserve the right to require this. The main restaurant will be on the second floor of the south office block, giving a good view of the airport; there will be a snack restaurant and bar within the main terminal on the first-floor concourse. Banks, post offices, car hire firms, etc, will have facilities in the entrance hall on the ground floor, and there will be various types of shops both in the entrance hall and in the concourse, where there will also be a nursery.

The foundations of the new building are well advanced, and the first half of the passenger building is expected to be ready by the second half of 1961, and the southern office block by the end of that year. The second half of the passenger building is due for completion early in 1962, and the northern office block by the end of 1962. BOAC, who handle about half the passengers at the existing north terminal, will move in during the late summer of 1961. Other operators will follow between six and 12 months later. The Director-General of Works, Air Ministry, is responsible for the construction, and the consulting engineers are Sir William Halcrow & Partners and G. H. Buckle & Partners.

The following figures, actual and estimated, were used in formulating the requirements for the building:—

	Yearly Total of Passenger Arrivals and Departures	Aircraft Arrivals and Departures
1958	720,000	23,000
1960	970,000	24,000–27,000
1965	1,655,000	25,000–29,000
1970	2,430,000	30,000–35,000

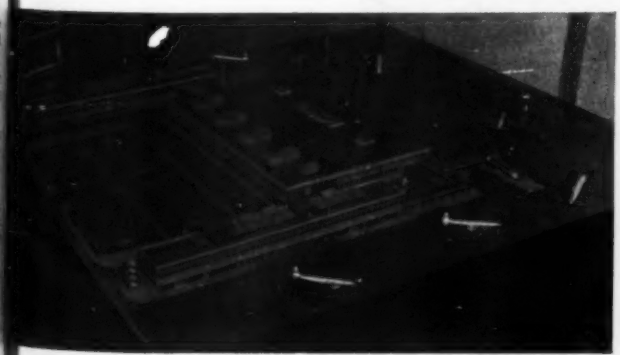
"Standard Busy Hour Rate" of Movements*

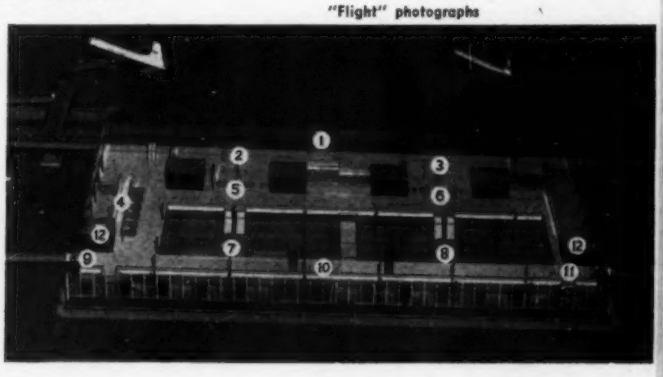
	Passengers	Aircraft
1958	341	10
1960	460	10 to 12
1965	785	11 to 13
1970	1,150	13 to 15

*This is the hourly rate of movement equalled or exceeded during 30 hours in the peak summer months. It gives a measure of near-peak conditions.

Left, general view of the model. Right, removal of the roof shows: (1) Spectators' gallery. (2) Final departure lounge. (3) Arrival lounge. (4) Snack restaurant and bar. (5) Customs (provision for) and immigration "comb." (6) Immigration. (7) Departures hall, and stairs up to concourse. (8) Arrivals hall, and stairs down to Customs and arrival hall. (9) Bridge to restaurant and south office block. (10) Balcony lounge. (11) Bridge to north office block. (12) Lifts

"Flight" photographs





SERVICE AVIATION

Air Force, Naval and Army Flying News

Honorary Royal ADC

IT was recently announced that Air Cmdt A. Stephens, Director of the WRAF, had been made an Honorary Aide-de-Camp to the Queen. She succeeds her predecessor as Director, Air Cmdt Dame Henrietta Barnett, in the appointment.

FOFT-designate

AMONG new Naval appointments is that of Rear Admiral F. H. E. Hopkins as Flag Officer Flying Training, from September this year, in succession to Rear Admiral D. R. F. Cambell. At present Captain of the Britannia Royal Naval College at Dartmouth, Rear Admiral Hopkins qualified as an observer in 1934 and in the war was awarded the DSC and DSO, training as a pilot. Before going to Dartmouth he commanded HMS *Ark Royal*.

Pakistan to Upavon

FORMERLY Assistant Chief of Staff (Maintenance) with the Pakistan Air Force, Air Cdre J. K. Rotherham has become Senior Technical Staff Officer at Transport Command headquarters. Before going to Pakistan he was on air engineering duties at Air Ministry, and he served as Senior Technical Staff Officer at Task Force HQ during the Suez operation. He was made an OBE in 1946.

AAFCE-CRE Changes

TWO air commodore postings were recently announced which involve changes between Allied Air Forces Central Europe headquarters and the Central Reconnaissance Establishment at Brampton, Hunts. Air Cdre E. G. Jones is to be Assistant Chief of Staff (Intelligence) at AAFCE headquarters from June 15; and he has been succeeded as Commandant of the CRE by Air Cdre L. Fox, formerly Assistant Chief of Staff (Operations and Training) at AAFCE.

Air Cdre Jones, who won the DFC and DSO within six months in 1941 while commanding No 80 Sqn in Greece, was CO at Wyton before going to the CRE in January last year. He is a CB and CBE. His successor at CRE, Air Cdre Fox, was a pre-war test pilot at the Marine Aircraft Experimental Establishment and during the war won the DFC while serving with No 209 Sqn and the DSO for his leadership of No 203 Sqn.

Wessex Trials

SOME favourable comments on the Westland Wessex were made by Lt Cdr Rex Turpin, who commands 700H Flight, when the first two production aircraft were formally handed over to the Royal Navy at Yeovil on April 1 (*Flight*, same date). Describing the machine as "a real breakthrough for the Navy so far as helicopter flying is concerned," he referred to electronic equipment which enables the Wessex to be flown blind and on night operations.

Westland Aircraft, describing it as "the first helicopter to join the Navy capable of both finding and destroying enemy submarines," have stated that the Wessex is eventually to be fitted with equipment giving it a "hands-off" hovering capability. Powered by a single Napier Gazelle gas turbine engine which has a one-hour rating of 1,450 s.h.p., it is the largest helicopter yet ordered by the Royal Navy. Service trials by 700H Flight are being done from RNAS Culdrose. (Picture, page 520.)

MHU Members Wanted

PROGRESS reports from the three Maritime Headquarters Units set up last year indicate that recruitment of RAuxAF personnel is coming along steadily but slowly. No 1 MCU at Northwood, with a complement of nearly 500 has had 120 applications; No 2 at Edinburgh, with a complement of nearly 300, has a strength of 70 (taken over from the former FCU) and has had "30 plus" applications; while No 3 (Plymouth) has so far had 120 applications for a complement of nearly 250.

The FCUs, attached to Coastal Command and its two Group headquarters, have as their task the manning of operations rooms and communications equipment during exercises and in time of war. Their immediate aim is preparing for the big NATO exercise taking place from September 17 to October 1. Both men and women, aged 17½ to 45, may join and there are several types of trade: signals offic (who must be fully trained), telegraphi teleprinter operators, wireless operato operations clerks, photographers, cler cooks and stewards. Training takes pla one evening a week and one weekend month, with a 15-day annual continu period; and appropriate pay and allo ances, plus a bounty, are payable.

Musical Adieu

NO bandmaster could have had a m illustrious farewell: a crowded Ro Festival Hall; the Hallé Orchestra und his baton for the *"Spitfire" Prelude a Fugue* by Sir William Walton; a gracio verbal tribute from Sir John Barbiro and the latter's insistence on *The Ro Air Force March Past* as a valedicto item. So Wg Cdr A. E. ("George") Sa ended his 39 years' RAF service, sin 1949 as Director of Music, at the fi RAF Anniversary Concert on Wednesd last week. Manchester-born, it was fitti that his farewell should have been w Manchester's great orchestra; and the pl ing of the RAF Central Band, which joi the Hallé at the end of the evening in *Overture "1812"* by Tchaikovsky, be witness to the efficiency and cheerfuln with which George Sims has dispen his task and now deservedly earns reti ment.

IN BRIEF

Princess Alexandra was due to visit R Wattisham, base of Nos 41, 56 and 111 Sq last Tuesday.

RAF Binbrook was transferred to Bomber Command to Fighter Command April 1.

HMS *Albion*, sister ship of *Bulwark* expected to be similarly converted to the Co mando carrier role when she returns to the after her present commission.

We regret to record that Air Marshal James Kilpatrick, Dean of the London Sch of Hygiene and Tropical Medicine since and previously Director-General of RAF Me cal Services, died suddenly on April 4 at age of 58.

HMS *Hermes* "came through admirab in the words of her captain (Capt D Tibbits), when she encountered severe gal returning from her Mediterranean shake-d cruise. At one stage, Capt Tibbits said, hi seas were washing over the end of the deck and the carrier rolled up to 11 degrees

The Headquarters Bomber Command A ciation of Officers is holding its fifteenth an reunion at Bomber Command headquar RAF High Wycombe, Bucks, on Satu May 21. Members who have not yet rece details may obtain them by applying to honorary secretary at Bomber Command

The RN Seaplane Bases, Port Said Alexandria, Old Comrades' Association bodying former members of No 269 Sq holding its 38th all ranks' reunion at Chicken Inn Restaurant, Wilton Road, toria, London SW1, on Saturday, May 6 p.m. Hon secretary is W. C. Shilling, grove," Kewferry Drive, Northwood, Mi

Air Marshal Sir Hector McGregor, AOC Fighter Command, meets French Air fighter pilots of No 12 Wing after they flown in their Super-Mystères to Watti on the occasion of President de Gaulle's visit. To the left of Sir Hector is Cmdt Do commander of the Wing; and on the C mandant's left is Gp Capt B. P. T. Ha who commands RAF Wattisham

CORRESPONDENCE

The Editor of "Flight" is not necessarily in agreement with the views expressed by correspondents in these columns. The names and addresses of the writers, not for publication in detail, must in all cases accompany letters.

Hydraulic Fluids

From Lord Brabazon of Tara

I WAS quite prepared to let my friend Sir Miles Thomas, in taking up some words in a speech of mine, get a certain advertisement for his Skydrol, as he explains it is so little known, but when he says [Correspondence, April 1] I was "unadvised of the availability" I can assure him that fire resistance by hydraulic fluids has been given much attention over some years and the existence of Skydrol is well known.

The operative word in my speech was "we" and it is true we in this country have no home-produced fluid that is satisfactory.

As to whether the American Skydrol is the complete answer to all demands is for Sir Miles to make good.

London W1 BRABAZON OF TARA

From Sir Miles Thomas, chairman, Monsanto Chemicals Ltd

YOUR correspondent Mr Bradley [April 1] misses the point when he speaks of fire hazards caused by spilled hydraulic fluid, and even more so when he compares the relative inflammability of fuel and hydraulic fluids in order to measure the contribution of the latter to overall safety. The reason for using Skydrol is that it cannot *itself* cause a fire.

Hydraulic fluid runs throughout the length and breadth of a modern aircraft, and is under a pressure of 3,000lb/sq in as against the 20lb/sq in of the fuel system. At this pressure a spray of mineral oil from a fractured hydraulic system is many times more inflammable and can easily be ignited by impinging on a hot surface, or by an electrical or friction spark. Thus even a relatively minor incident can cause mineral-oil hydraulic fluid to ignite, possibly leading to the subsequent ignition of fuel.

A survey of 93 aircraft hydraulic-fluid fires between 1953 and 1957 shows that 78 were caused by ignition of fluid sprays.

Under these 3,000lb spray conditions Skydrol 500A cannot be ignited by red-hot brake drums, engine manifolds, electrical sparks or any of the usual causes of aircraft fires. That it burns, as Mr Bradley says, in wick lamps is irrelevant. The lamp must be ignited by something already alight.

If an aircraft is already ablaze Skydrol may burn with it, but Skydrol will not ignite by itself. Aircraft equipped with it have now flown 16 million flight hours without a hydraulic-fluid fire. It surpasses the requirements of a specification (AMS 3150B) prepared by experts from all sides of the American aviation industry for a fire-resistant hydraulic fluid, and is used by most of the leading world airlines.

London SW1 MILES THOMAS

The Air Transport Licensing Bill

THERE is a point in this Bill which has raised no comment so far but which (if I read the Bill correctly) could mean a great deal to the independents, and that is the right of the Licensing Board to examine and approve tariffs for any air route licences the board grants.

A great deal of charter flying is on holiday flights or "inclusive tours" (as these are mostly called), and the cost for the aircraft either *in toto* or *per capita* is a trade secret known only to the tour organizer and his carrier.

We do know that as things stand the cost of air travel on an average holiday flight to Spain, Italy, etc., is substantially lower than the cheapest BEA fare to the same terminal or area. It will now be within the powers of the board to alter all this and to say: "This fare you propose is too low and must be brought more in line with the advertised fare."

Any increase in air holiday fares would, I think, rule out air holidays abroad for many of the lower-income groups, so that this type of holiday may for many be a memory only.

Pinner, Middx JOHN A. MACDONALD, Gp Capt, RAF (Retd)

The RAAF and Viscounts

IN his article "What will the RAAF Buy?" (April 1) Stanley Brogden is less than fair when he states, in effect, that Britain didn't care about (or give any priority to) the RAAF need for VIP aircraft, whereas the USA did.

The RAAF were shopping for two VIP aircraft in the winter of 1955, and had more or less decided in principle to order Viscounts. It is true that, because of a rush of orders, there was a delay at that time on Viscount deliveries, but these difficulties did not appear to be insuperable. The RAAF was well aware of the position. The USAF then made a free gift ("permanent loan") of two Convairs to the RAAF with virtually immediate delivery. That settled the matter. No one could compete with that.

Mr Brogden should note (and, in fact, he well knows) that these two Convairs were not given or expedited to the RAAF by the manufacturers. They were given by the USAF out of their own order—presumably because they were surplus to requirements. The RAF has never ordered Viscounts and consequently had no rival Viscounts to donate. Vickers, with this large rush of civil Viscount contracts to fulfil, equally had no spare aircraft.

In any event, no manufacturer can ever offer anything like immediate delivery off a production line. There is always a backlog, and the only way a quick sale can be made is if an existing customer is willing to surrender his place on the line, or fails to take delivery. In the USA it was the USAF who gave up two places at the front of the Convair line, and that is why the RAAF now has the American built piston-engined VIP aircraft.

One can't blame the Australians for accepting an immediate-delivery free gift. Nor can one seek to look behind a generous gesture by the Americans. Britain was simply not in a position to rival that gesture.

Weybridge, Surrey CHARLES GARDNER, Sales Publicity Manager, Vickers-Armstrongs (Aircraft) Ltd

Soviet Rocketry

WITH reference to the "mystery" Soviet rockets shown on page 358 of *Flight* for March 18: in Karl Gilzins' *Sputniks and After* (Macdonald, London), it is illustrated opposite page 48 and is captioned, "In May 1957 a Soviet rocket carrying 2,200kg of experimental equipment reached a height of 212km. The launching is shown here; and the instrument containers can be seen attached to the rocket. Both animals and equipment were sent up and returned safely."

Leigh, Lancs A. CRITCHLEY

Transport Airships

I AM surprised that in his advocacy of the airship, in a letter published in your issue of March 11, Cdr Croker omitted any reference to R.100.

London W1 F. H. SMITH

FORTHCOMING EVENTS

April 14-24. International Air and Space Exposition, Los Angeles.
April 19-21. International Airline Navigators' Council: Tenth Annual Convention, New York.
April 20. Kronfeld Club: "International Sporting Parachuting," by Mike Reilly.
April 20. London and Home Counties Regional Advisory Council for Technological Education, and Brunel College of Technology: Conference on the Selection of Materials.
April 20-22. Institute of the Aeronautical Sciences: National Symposium on Manned Space Stations, Los Angeles.
April 20-24. Constantine Aero Club Rally.
April 22. RAeS Agricultural Aviation Group: "Pilot Training," by Capt Richard Bradbury.
April 27. Kronfeld Club: "The History of the Royal Observer Corps," by H. Gorden.
April 28. British Interplanetary Society: "High-altitude Chambers and Pressure Suits," by Dr E. W. Still.
April 28. Institute of Transport: 1960 Congress, London.
April 30-May 8. Rally and Second-hand Aircraft Sale, Cosnes, France.
May 3-13. Mechanical Handling Exhibition, Earls Court, London.
May 4. British Institution of Radio Engineers (Computer Group): "Computer-controlled Television Displays for Flight Simulators," by J. N. Naish.
May 4. Kronfeld Club: "Army Aviation, Past and Present," by Maj P. A. Downward.
May 5. RAeS: Annual General Meeting.
May 6. RAeS Rotorcraft Section: "The Personal Helicopter," by J. S. Shapiro.
May 6-8. Shackleton Sales Weekend, Kidlington, Oxon.
May 11. RAeS: Second Halford Memorial Lecture (at Hatfield), "Powerplants for Supersonic Transports," by J. S. Alford.
May 11. British Institution of Radio Engineers (Radar Group): "Radio Guidance in the Automatic Landing of Aircraft," by J. Shayler.
May 11. Kronfeld Club: "Around the USA," second of two lectures by John Furlong.

RAeS Branch Fixtures (to April 22): April 20, *Reading*, "The Radio Telescope," by Dr H. P. Palmer. April 21, *Yeovil*, Junior Paper Evening. April 22, *Birmingham and Wolverhampton*, Film Evening.

The Multi-Jet noise suppressor on its specially designed trailer during performance tests at RNAS Lossiemouth. (See first item below.)

Sound Ideas

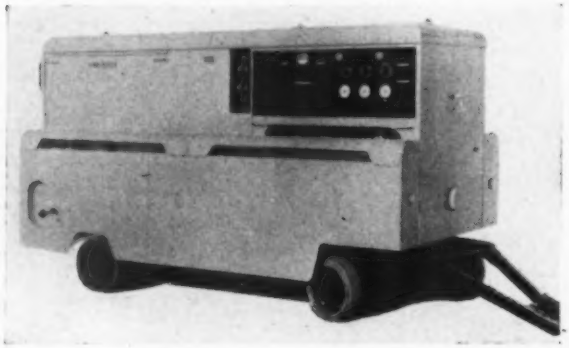
EFFECTIVE suppression of jet noise on take-off is an intractable problem, but silencing of jet engines on the ground is more amenable to well-known techniques of noise reduction. Recently established in this country is a new concern, Industrial Acoustics Co Ltd, 50 Mount Street, London W1, which is now producing equipment for this purpose. It is marketing the products of a US parent organization of the same name and in particular a mobile "Multi-Jet" noise suppressor. Advantages claimed for this unit are low weight, and dimensions much smaller than that of present equipment which performs a comparable task. The Multi-Jet noise suppressor can be mounted on a fixed stand, on a trolley or—in certain cases where provision was made in the installation—directly on to the power unit; the aircraft can be moved with the suppressor in place. In the last-named case it is claimed that a noise reduction of 20-30 decibels is possible on an aircraft such as the Boeing 707.

So far the British company have demonstrated only the mobile suppressor shown in the photograph. This was recently tested by the Navy on a Scimitar at Lossiemouth and the acoustical performance was measured by the National Physical Laboratory and other independent observers. It is said that the attenuation compared favourably with much heavier and less mobile units, and test data from the NPL should be published shortly.

The principle on which the suppressor works is inhibition of the generation of noise rather than the reduction of noise after it has been fully generated. This is accomplished by the diffusing action of the unit, which reduces the high-velocity gases to a relatively low velocity. It is the shear action of the still air by high-velocity gases that normally creates high noise-levels.

Some latitude is possible in the design to enable one trolley to be offered up to different engine installations, but in an application such as the Boeing 707—where a silencing nozzle is already attached to the engine—the unit must be specially adapted.

Vernons Industries, of Liverpool, recently delivered to BOAC the first of four 400c/s 100kVA electric/electric ground power units. Stated to be the first of its kind, the unit has a brushless alternator driven by a brushless, self-starting salient-pole synchronous motor. Though designed for use in hangars, these GPUs are fully weatherproofed. They are working with Qantas Boeing 707s until BOAC's 707s arrive



THE INDUSTRY

Electrical Standard Revised

THE British Standards Institution announces that British Standard G.100, *General Requirements for Aircraft Electrical Equipment*, is being revised to take account of the requirements of modern high-performance aircraft operation, and in the light of experience of working to the provisions of the first edition, which was published in 1952. The revised standard will, of course, be of extreme importance to the industry, as it provides the basis of ARB approval of electrical and certain other equipment for civil aircraft.

Part 3 of the revision has been completed and (at the request of the industry) published in advance of other parts of the new standard, which are still in course of preparation. The complete revised standard will consist of the following parts (other parts may be prepared as required), which will be issued separately: (1) Declarations, identifications and construction; (2) environmental and operating conditions; (3) characteristics of electrical power systems and equipment; (4) instruments and indicators; (5) rotating electrical machines.

It is not intended, says the BSI, that the new standard should be applied retrospectively. Existing equipment will remain in use for some time, and the matching of new equipment with old systems (and vice versa) will need consideration.

Copies of Part 3, the identification details of which are B.S. 2G.100, part 3, 1960, may be obtained from the British Standards Institution, Sales Branch, 2 Park Street, London W1. Price 6s (postage is extra to non-subscribers).

IN BRIEF

Capt John Crewdson, managing director of Executair Ltd, wearing an "Airlite" headset with noise-cancelling boom microphone and liquid-filled ear-pads. He recently flew his company's Widgeon to the Harlow, Essex, factory of Airmed Ltd to collect six of these headsets, which will be used by Executair for pilot/passenger intercom in Executair's helicopters. Similar equipment is used by crews of many well-known airlines

C. H. Barden has been appointed to the Technical Sales Department of Smiths Aviation Division at Wembley; he was previously with the company's research and development organization at Cheltenham.

Ivon A. Bailey has been appointed deputy chairman of the Mond Nickel Co Ltd and of Henry Wiggin Co Ltd, and Edward Vaughan has been appointed a director of both companies.

Simmonds Aerocessories Ltd, a member of the Firth Cleveland Group, have recently published the sixth edition of their Technical Data Manual on AGS. 2,000 Series Nyloc aircraft nuts. Copies are available from the company at Treforest, Pontypridd, Glam.

We regret to record the sudden death, on March 28, of Philip Frank Wright, joint assistant managing director of the B.B. Chemical Co Ltd, of Leicester. Mr Wright, who was 42 years of age, was appointed assistant to the technical director in 1948 and factory manager in 1951.

R. I. T. Faulkner has joined the Sperry Gyroscope Co Ltd as general sales manager of the Brentford Division, with special responsibility for marine and aircraft equipment. He was previously with the Plessey Co, becoming general sales manager of the Telecommunications Division.

The Technical Service (Aircraft) Division of the Firestone Tyre & Rubber Co Ltd has published a brochure, *Aircraft Tyre and Tube Maintenance and Repair Manual*, which gives guidance on the limits to which aircraft tyres can be worn before removal and has excellent illustrations of various forms of maintenance work.

E. Trees recently became assistant manager (sales), aviation department, Shell-Mex & BP Ltd on the retirement of V. C. Varcoe. After his retirement in 1956 from the RAF, in which he at one time commanded No 71 Sqn when it was equipped with Sabres, he became aviation manager of the Shell-Mex & BP London Division.

Dr Edmund T. Price, BS, LHD, until recently president of Solar Aircraft Co in San Diego, has been appointed managing director of Tiltman Langley Ltd under recent management changes. He was made chief executive last October. Other changes are the re-appointment of L. A. Wingfield, MC, DFC, as chairman and Leslie D. Neeves as secretary. Other appointments to the board include Marcus Langley, A. Kenneth Clyde and W. E. Patrick Johnson.